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PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL.

P6230 PROBE

INSTRUCTION MANUAL

Serial Number ______________ First Printing APR 1983

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070-4211-00
Product Group 60

TABLE OF CONTENTS

WARNING

The following servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing other than that contained in operating instructions unless you are qualified to do so.

TABLE OF CONTENTS (cont)

LIST OF ILLUSTRATIONS

LIST OF TABLES

OPERATORS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms In This Manual

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

Do Not Operate In Explosive Atmospheres

To avoid explosion, do not operate this product in any explosive atmosphere unless it has been specifically certified for such operation.

Do Not Remove Covers

To avoid personal injury, do not remove the product covers. Do not operate the product without the covers properly installed.

SERVICE SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

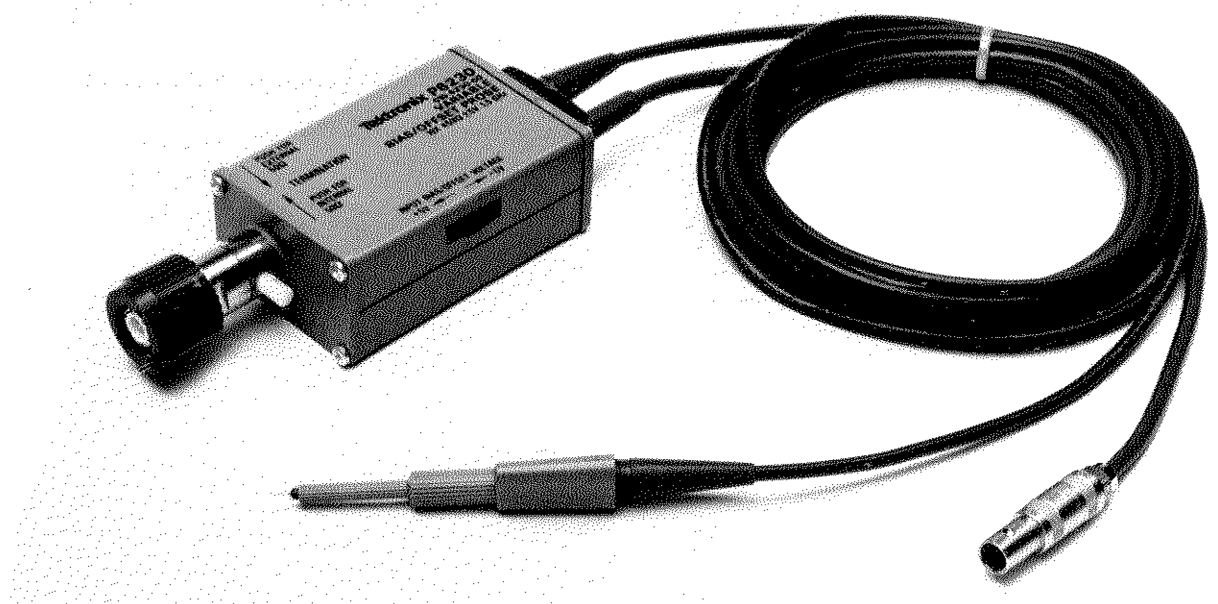
Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation.

Use Care When Servicing With Power On

To avoid personal injury, do not touch exposed connections and components while power is on.



4211-01

The P6230 Probe.

SPECIFICATION

DESCRIPTION

The TEKTRONIX P6230 is a low-impedance, subminiature, 10X active probe for use with broad-band oscilloscopes. The P6230 is equipped with an internal/external 50-ohm termination switch which allows the probe to be used on scopes having an input resistance of either 50Ω or 1 MΩ. A coding pin on the BNC connector advances the Volts/Division reading by 10X, on oscilloscopes equipped with this feature, so that the correct deflection factor at the probe tip is indicated.

The compensation box of the P6230 houses an active circuit which provides a variable voltage at the probe tip. This voltage is used to minimize probe-loading effects. The voltage available at the tip of the P6230 spans the range from -5 volts to +5 volts, allowing the probe to minimize loading effects on most logic families that are in use today.

The P6230 is available with a 1.6-meter signal cable and a 1.4-meter power cable.

The subminiature probe head of the P6230 is fully compatible with the Tektronix family of subminiature probe accessories.

ACCESSORIES

The P6230 is shipped with the following standard accessories:

1 Instruction manual
1 Carrying pouch
1 Hook tip
2 Circuit-board-to-probe-tip connectors
1 Ground lead with microhook
1 Low-inductance ground lead
1 Ground lead with alligator clip
1 Probe holder
4 Sets of cable markers (2 each: white, gray, red, green)

Use of these accessories is described in the "Operating Instructions" section of this manual. Part numbers and optional accessories are listed in the "Replaceable Parts List" (Section 7).

PERFORMANCE CONDITIONS

The electrical characteristics listed in Table 1-1 apply when a calibrated probe is used with a calibrated oscilloscope system operating within the environmental conditions stated in Table 1-2.

Items listed in the "Performance Requirement" column are verifiable qualitative or quantitative limits.

Items listed in the "Supplemental Information" column are not verified in the "Performance Check Procedure" (Section 3); they are either explanatory notes, calibration setup descriptions, performance characteristics for which no absolute limits are specified, or characteristics that are impractical to check.

The probe's physical characteristics are listed in Table 1-3.

Table 1-1

Electrical Characteristics

Characteristic	Performance Requirement	Supplemental Information
Attenuation (system)	10X ±3% at dc.	Probe terminated by 50Ω ±0.5%.
Input Resistance (system)	450Ω ±1% at dc.[a]	Probe terminated by 50Ω ±0.5%.
Input Capacitance (1 kHz to 1.5 GHz)	Less than 1.6 pF.[a]	Typically 1.3 pF. See Figure 1-1 for a graph of input impedance versus frequency.

[a] Performance Requirement not checked in manual.

Table 1-1 (cont)

Characteristic	Performance Requirement	Supplemental Information
Bandwidth (−3 dB) (Probe only)	DC to at least 1.5 GHz.	Calculated from probe rise time. BW = 0.35/rise time.
Rise Time (Probe only)	Less than 230 ps.	Test system must have a rise time less than 100 ps.
Aberrations (Probe only)	Less than +4%, −6%, 8% p-p for the 1st ns, ±3% thereafter.	In addition to system aberrations.
Signal Delay	8.70 ns ±100 ps.[a]	Probe tip to output BNC.
Input Dynamic Range	$-5\ V \leq (V_{signal} + V_{offset}) \leq +5\ V$	
Offset Null	Less than ±10 mV.	
DC Offset Range	0 to at least +5 V and −5 V.	Measured from probe tip to ground with a high impedance (≥ 50 kΩ/V) voltmeter.
DC Thermal Drift	Less than 10 mV/hr/°C.[a]	Equivalent input offset voltage.

[a] Performance Requirement not checked in manual.

Table 1-1 (cont)

Electrical Characteristics

Characteristic	Performance Requirement	Supplemental Information
Output Load Requirement	50Ω ±0.5%.[a]	
Maximun Nondestructive Input Voltage	10 Vdc continuous. 30 V (dc + peak ac) for 1 sec.[a]	
Power Supply Requirements	Tektronix Oscilloscope Probe Power Supply.	+15 Vdc ±4%. −15 Vdc ±4%. Less than 10 mV ripple (20 Hz to 500 Hz).

[a] Performance Requirement not checked in manual.

Table 1-2

Environmental Characteristics

Characteristic	Information
Temperature Range (Operating)	0°C to +50°C (+32°F to +122°F).
Temperature Range (Nonoperating)	−55°C to +75°C (−67°F to +167°F).
Humidity	Five cycles (120 hr.) at 90% to 95% relative humidity at 30°C to 60°C.
Altitude (Operating)	To 4,600 m (15,000 ft).
Transportation	Qualifies under National Safe Transit Association's Pre-shipment Test Procedures; 1A-B-1.

Table 1-3

Physical Characteristics

Characteristic	Information
Net Weight (includes accessories)	400 g (14 oz).
Signal Cable Length	1.6 m (61 in).
Power Cable Length	1.4 m (54 in).

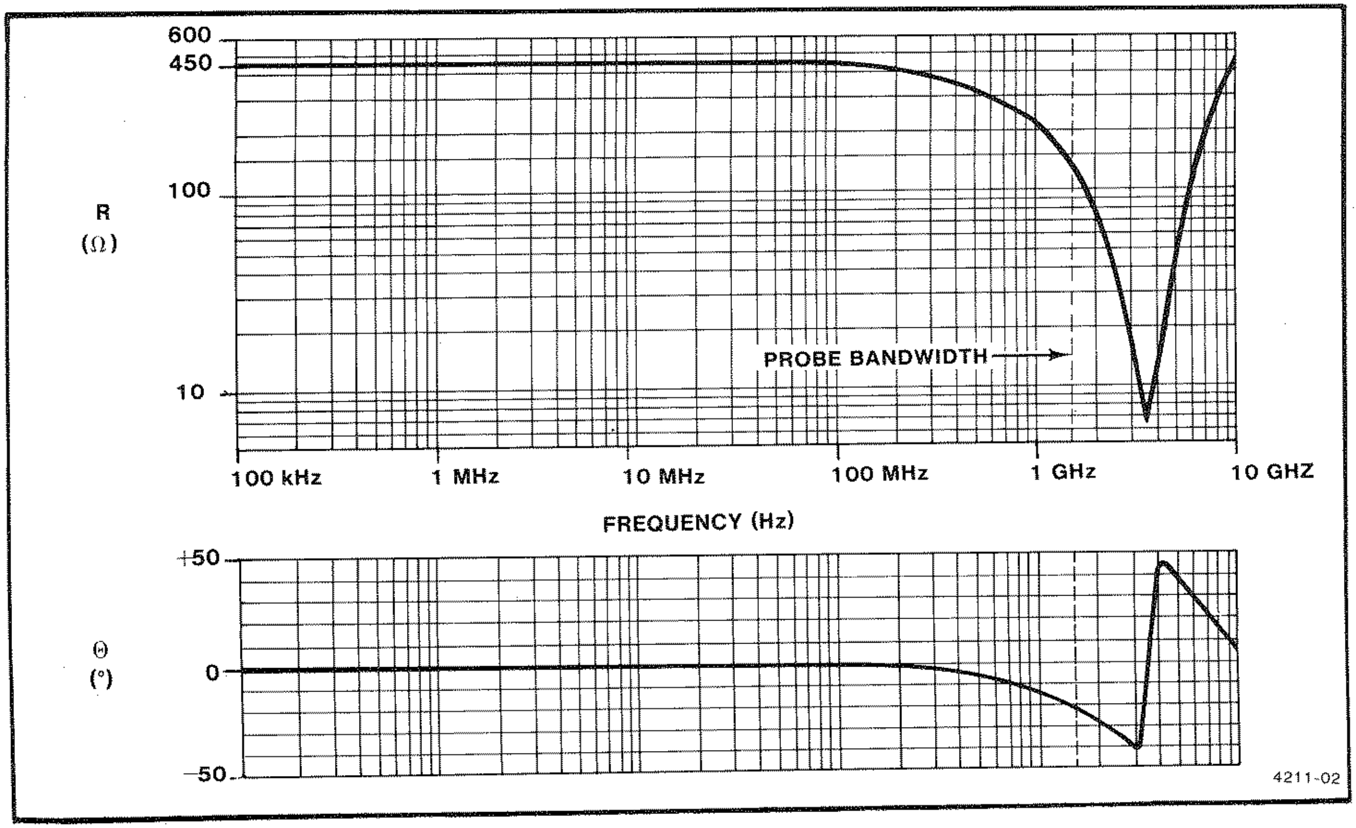


Figure 1-1. Typical input impedance versus frequency.

OPERATING INSTRUCTIONS

INTRODUCTION

This section of the manual is intended to familiarize the operator with the use of the P6230 Probe. Included are operating considerations, descriptions of the controls and connectors, instructions for the use of the accessories, and a description of the use and operation of the probe.

NOTE

The P6230 is shipped in a carton along with its standard accessories. At installation time, save the shipping carton and packaging materials for reuse should reshipment become necessary. Refer to "Maintenance" (Section 6) for further information.

OPERATING CONSIDERATIONS

Probe Handling

The P6230's subminiature body has been designed for ease of use when probing small circuitry. Both the probe itself and its accessories should be handled carefully at all times. To prevent damage, avoid dropping the probe body, since damage to its tip may result. Exercise care to prevent crushing the cable or placing excessive strain on it by pulling.

Probe Grounding

A probe is a capacitive divider for high-frequency signal components. Inductance introduced by either a long signal lead or ground lead will form a series-

resonant circuit that can distort the true waveform or degrade the bandwidth. The ground lead and signal-input connections should be kept as short as possible to maintain the best waveform fidelity.

Input Dynamic Range

The input dynamic range of the P6230 is limited by the ability of the internal amplifier to drive the 50Ω termination. This limitation exists whether the input signal originates at the probe tip (test signal) or the internal offset voltage. Therefore, the limitation on the signal that can be applied to the probe tip is dependent on the amount of offset voltage being used. To maintain signal fidelity, the test signal should not exceed the limits imposed by the following formula:

$$-5.0\ V \leq (V_{signal} + V_{offset\ voltage}) \leq +5.0\ V$$

DESCRIPTION OF CONTROLS AND CONNECTORS

The following information will familiarize the operator with the location and function of the external controls and connections of the P6230. Please refer to Figure 2-1.

(1) **Input Power Connector** - Connects the probe to the probe power receptacle on either the oscilloscope mainframe or an accessory power supply.

(2) **INPUT BIAS/OFFSET VOLTAGE** - Continuously variable control that sets the level of the voltage supplied to the probe tip.

(3) **INT-EXT Switch** - Selects the source of the 50-Ω load required by the output of the P6230.

INT - A precision 50-Ω resistor is internally

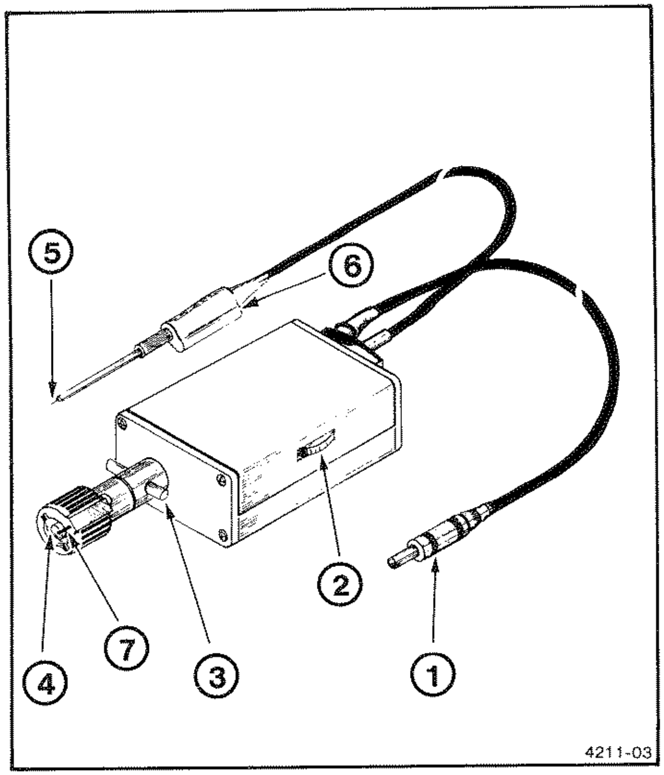


Figure 2-1. Controls and connectors.

connected across the output of the P6230. This selection is used when the probe is connected to an instrument having an input impedance of 1 MΩ or greater.

EXT - The internal load is removed from the output of the P6230. This position should be used when the probe is connected to an instrument that has an input impedance of 50Ω ±0.5% available.

(4) **Output BNC** - Used for connecting the output of the P6230 to the input of an oscilloscope or other test instrument.

(5) **Probe Tip** - Used to apply the test signal to the probe/instrument system.

(6) **Ground Lead Socket** - Used to connect the standard-accessory ground leads.

(7) **Readout Connector** - The spring-loaded contact finger actuates the readout circuitry of oscilloscopes equipped with this feature. When the

probe is attached to the input connector of the oscilloscope, the Volts/Division reading will automatically advance by 10× so that the correct deflection factor at the probe tip is indicated.

PROBE ACCESSORIES

Both standard and optional accessories for the P6230 are listed in the "Replaceable Parts List" near the back of this manual. Standard accessories are supplied to aid in connecting the probe to circuitry under test and to protect the probe against damage. These accessories are described in the following paragraphs and are illustrated in Figure 2-2.

Probe Holder

Each probe holder provides a convenient means of storing two probes in a readily accessible location. The holder has adhesive on the rear side to enable attaching it to an oscilloscope. To install the holder, peel off the protective covering from the adhesive and attach the holder to the cabinet side, preferably near the vertical inputs. For maximum strength, the holder should be left to set for 48 hours before inserting any probes. When a probe is not in use, insert its tapered portion (behind the probe head) into the holder.

Ground Leads

The P6230 Probe is supplied with three ground leads: a 150-mm (5.9-in) lead with a microhook, a 250-mm (9.8-in) lead with an alligator clip, and a 40-mm (1.6-in) low-inductance lead. To minimize distortion, always use the shortest possible ground lead. Refer to Table 2-1 for typical effects on performance for the various grounding configurations. Each ground lead is equipped with a square-pin connector which plugs into the socket in the probe's grounding collar.

Before using the low-inductance lead, remove the light-grey probe-body shell and flip the grounding collar so that the socket faces toward the probe tip. Then replace the probe body shell and install the ground lead (see Figure 2-2).

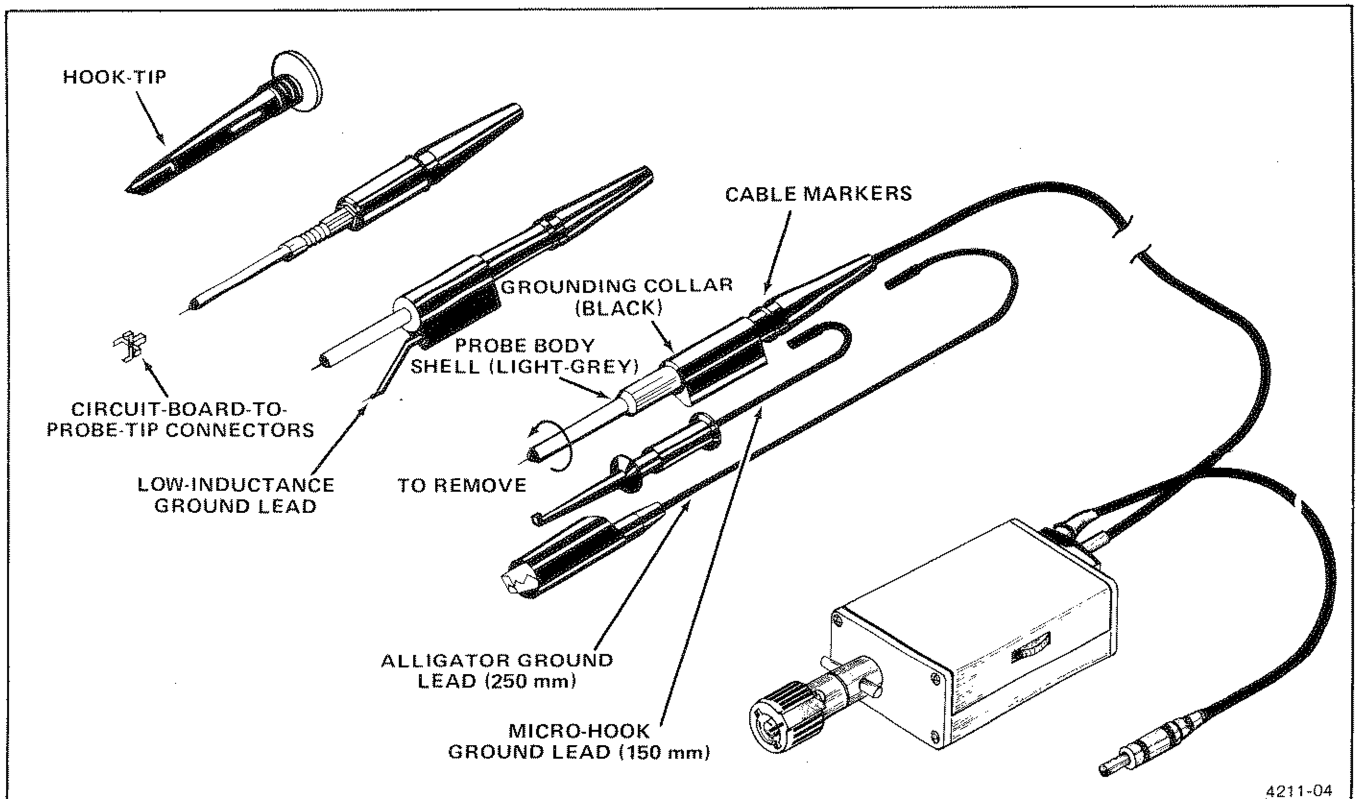


Figure 2-2. Installation of probe accessories.

Table 2-1

Typical Performance Effects of Grounding Configurations

Grounding Method	Risetime	Bandwidth (calculated)
Probe tip-to-GR adapter.	230 ps.	1.5 GHz.
Low-inductance lead.	440 ps.	800 MHz.
6.5-inch lead.	1.0 ns.	350 MHz.
9.5-inch lead.	2.0 ns.	175 MHz.
No ground lead.	16 ns.	22 MHz.

Cable Markers

Cable markers are provided in four different colors to help identify specific probes when using multichannel oscilloscopes.

Circuit-Board-to-Probe-Tip Connectors

Two circuit-board-to-probe-tip connectors are provided for making permanent probe test points on circuit boards. These connectors provide extremely short signal and ground paths to minimize ringing. Before inserting the probe tip into a connector, remove both the light-grey probe-body shell and the grounding collar from the tip.

Hook Tip

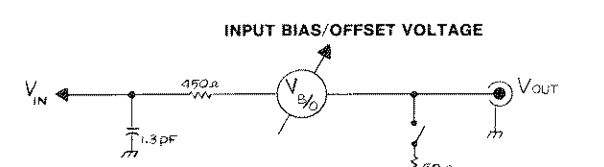
The hook tip provides the means for making a hands-free connection to a test point or component lead. To install the hook tip, just slide the hook tip onto the probe.

Carrying Pouch

The carrying pouch (not shown) is a durable, sealable pouch designed to protect the probe, its accessories, and this manual when they are not in use.

OPERATION

The P6230 may be considered to act as a standard 500-Ω passive voltage probe with the additional capability of having an adjustable tip "nulling voltage." (Refer to Figure 2-3 for a simplified functional block diagram of the probe.) This feature reduces the dc-loading effects of the probe when it is used to measure signals whose mid-voltage value is other than zero volts, or in circuits where the termination impedance is returned to other than ground level. The INPUT BIAS/OFFSET VOLTAGE may be adjusted so that at a particular test-signal voltage both ends of the 450-Ω resistor are at equal potentials and no current is flowing through the resistor.



$$V_{OUT} = \frac{V_{IN} - V_{B/O}}{10}$$

Figure 2-3. Simplified functional diagram.

Example:

The advantages become very apparent in examining the loading effects on a logic family such as ECL. ECL logic is most commonly operated from a −5.2 V supply with Vcc connected to ground. In this configuration, the high signal level is approximately −0.8 V and the low signal level is approximately −1.7 V. The output of an ECL gate is the emitter of an NPN emitter follower stage whose collector is connected to ground. The output is pulled down to a negative supply (usually about −2 V) with an external resistor (usually 50 to 100 ohms). Refer to Figure 2-4 . Since speed is a major consideration in ECL designs, the interconnections between gates are often transmission lines, and the pull-down resistor doubles as a line termination.

If a standard 500-Ω , 10X probe without the INPUT BIAS/OFFSET feature were used to examine an ECL output, the probe's 500Ω resistance to ground would form a voltage divider with the gate's output-termination resistor. This divider can cause severe distortion of the output signal levels, shift the dc-operation point of the output transistor, and greatly reduce the gate's noise margin.

The dc-load nulling capability of the P6230 solves this problem. By adjusting the INPUT BIAS/OFFSET VOLTAGE to the ECL low level or to the termination voltage, the only effect of the probe resistance will be a small decrease in the ECL output-termination resistance. The effect of the probe on output voltage levels is negligible. Figure 2-5 shows typical effects to be expected when examining ECL signals.

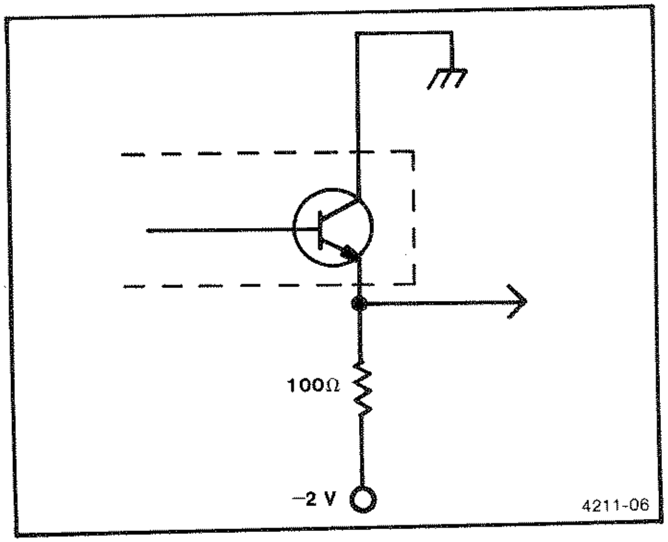


Figure 2-4. Typical ECL output circuit.

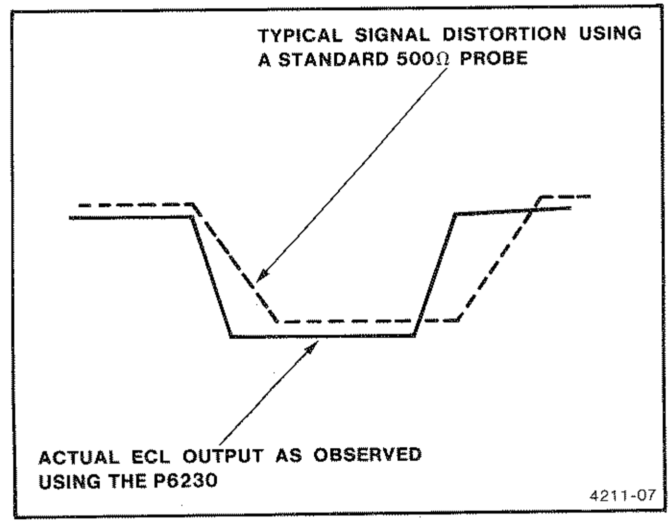


Figure 2-5. Typical loading effects on ECL.

PERFORMANCE CHECK PROCEDURE

PURPOSE

The "Performance Check Procedure" is used to verify the probe's Performance Requirements as listed in "Specification" (Section 1) and to determine the need for readjustment. This procedure may also be used both as an acceptance check and as a test of the probe after repair.

This section contains only the procedures for checking the P6230's dc offset range and high-frequency characteristics. The check procedure for the probe's attenuation accuracy has been combined with the probe's adjustment procedures due to the sameness of their setups. This check/adjustment may be found in "Adjustment Procedures" (Section 4).

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 3-1 is a complete list of equipment required to accomplish the "Performance Check Procedure." Test equipment specifications described in Table 3-1 are the minimum necessary to provide accurate results; therefore, equipment used must meet or exceed the listed specifications. Detailed operating instructions for test equipment are not contained in this procedure. Should additional operating information be needed, refer to the appropriate test-equipment instruction manual.

LIMITS AND TOLERANCES

The limits and tolerances given in this procedure are for the P6230 under test only. Test-equipment error is not included except as noted.

PREPARATION

Before proceeding with the check, allow sufficient warm-up time for test equipment to stabilize (typically 20 minutes).

Table 3-1

Test Equipment Required

Item Number and Description	Minimum Specification	Purpose	Example of Suitable Test Equipment
1. Real Time Oscilloscope	Bandwidth: dc to about 15 MHz. Vertical deflection factor: 5 mV to 1 V.	Offset range check.	TEKTRONIX 7704A with 7A26 and 7B80 plug-ins.
2. Digital Multimeter	DC volts accuracy: 0.1%	Offset range check.	TEKTRONIX DM 502A.[a]
3. DC Voltage Source	Output: + and − 5 V.	Offset range check.	TEKTRONIX PS 503A.[a]
4. Sampling Oscilloscope	Bandwidth: dc to 4.6 GHz.	HF checks.	TEKTRONIX 7704A with 7S12 plug-in.
5. Sampling Head	Bandwidth: dc to 4.6 GHz.	HF checks.	TEKTRONIX S-2.
6. Pulse Generator	Rise time: less than 25 ps.	HF checks.	TEKTRONIX S-52.
7. Termination Adapter	Impedance: 50Ω. Connectors: subminiature probe tip-to-GR.	HF checks.	Tektronix Part Number 017-0520-00.

[a]Requires a TM 500-Series power-module mainframe.

Table 3-1 (cont)

Test Equipment Required

Item Number and Description	Minimum Specification	Purpose	Example of Suitable Test Equipment
8. Adapter	Connectors: GR-to-BNC female.	HF checks.	Tektronix Part Number 017-0063-00.
9. Adapter	Connectors: SMA male-to-GR.	HF checks.	Tektronix Part Number 015-1007-00.

PROCEDURE STEPS

1. DC Offset Check

Equipment Required (see Table 3-1):

Oscilloscope (Item 1)
Digital Multimeter (Item 2)
DC Voltage Source (Item 3)

a. Connect the probe input power connector to the oscilloscope probe power and connect the probe output BNC connector to the oscilloscope's vertical input.

b. Set the probe's INT-EXT switch to INT.

c. Set the oscilloscope controls as follows:

Volts/Division	2 V
Input Coupling	GND
Time/Division	1 ms
Trigger Source	Internal
Trigger Mode	Auto

d. Vertically position the trace to the center horizontal graticule line.

e. Set the oscilloscope input coupling to DC.

f. Touch the probe input to a convenient ground point on the test oscilloscope.

g. CHECK — That the INPUT BIAS/OFFSET VOLTAGE control is able to vertically position the trace over a +5.0 V to −5.0 V range.

h. Remove the probe input from the ground point. Connect the probe ground, via a probe ground lead, to the common input of the multimeter. Touch the probe input to the + input of the multimeter.

i. Set multimeter controls for DC volts, 20 V scale.

j. CHECK — That the INPUT BIAS/OFFSET VOLTAGE control is able to vary the voltage at the probe tip over a + and − 5.0 V range.

k. Remove the probe from the multimeter.

l. Using the multimeter to confirm, adjust the variable dc voltage source to +5.0 V.

m. Connect the probe ground, via a probe ground lead, to the voltage source common output. Touch the the probe input to the + output.

n. CHECK — that the INPUT BIAS/OFFSET VOLTAGE control is able to set the oscilloscope trace to 0.0 V.

o. Repeat Steps l through n with the voltage source set to −5.0 V and the probe connected to the − output.

p. Disconnect the test setup.

2. Bandwidth/Rise Time/High-Frequency Aberrations Check

Equipment Required (see Table 3-1):

Oscilloscope (Item 4)
Sampling Head (Item 5)
Pulse Generator Head (Item 6)
Termination Adapter (Item 7)
Adapter (Item 8)
Adapter (Item 9)

NOTE

The rise time and aberrations specifications of the pulse generator/sampling oscilloscope system are required to complete this check (see step g). These may be found in the "Specifications" section of the appropriate instrument manual or measured by performing the procedure given below while substituting a 50-Ω cable for the P6230 and increasing the Volts/Division setting by a factor of 10.

a. Connect the test setup as shown in Figure 3-1.

b. Set the probe's INT-EXT Switch to EXT.

c. Set the oscilloscope/sampling plug-in controls as follows:

Volts/Division	5 mV
Time/Division	50 pS

d. Adjust the sampling plug-in's DC Offset and Time-Distance controls to center the leading edge of the pulse on the screen.

e. Adjust the Volts/Division Variable control for a 5-division display.

f. Measure the rise time of the displayed waveform.

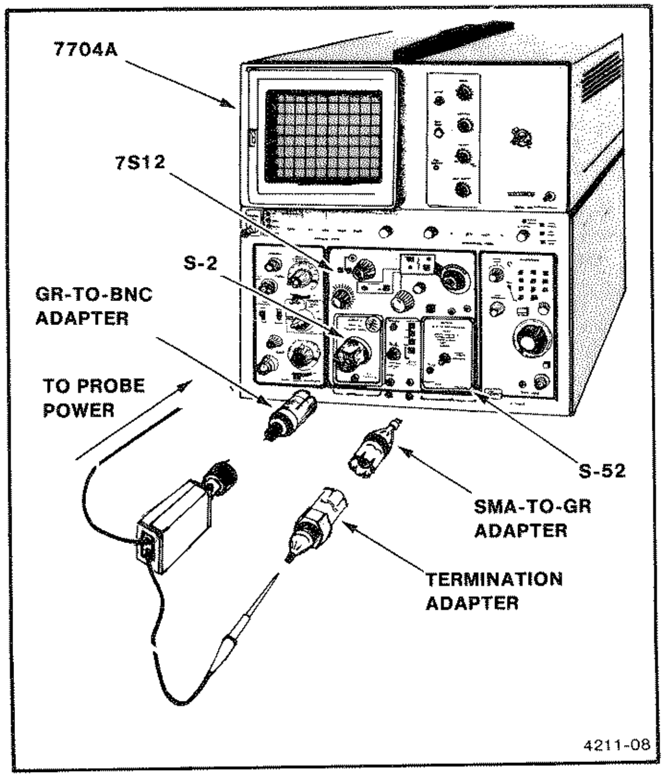


Figure 3-1. High-frequency check setup.

g. Calculate the probe rise time using the following formula:

$$\text{Probe Rise Time} = \sqrt{(\text{Measured rise time})^2 - (\text{Sampling system rise time})^2}$$

h. CHECK — The probe rise time calculated in part g should be less than 230 ps. This indicates a bandwidth of at least 1.5 GHz as calculated from the formula:

$$\text{Bandwidth} = 0.35/\text{Rise Time}$$

i. Set the oscilloscope/sampler Time/Division control to 500 pS.

j. CHECK — The high-frequency aberrations do not exceed +4% (5.2 divisions), or −6% (4.7 divisions), or 8% (0.4 divisions) p-p (in addition to system aberations.

k. Disconnect the test setup.

ADJUSTMENT PROCEDURE

PURPOSE

This section contains the information necessary to perform the attenuation, offset null, and mid-frequency adjustments for the P6230 Probe. The adjustment procedures are not intended to be troubleshooting guides, however, any deficiency found during performance of each adjustment step should be corrected before continuing. Tektronix Field Service Centers and the Factory Service Center provide instrument repair and adjustment service. Refer to "Maintenance" in Section 6 for further repair information.

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-1 is a complete list of equipment required to accomplish the "Adjustment Procedures." Test equipment specifications described in Table 4-1 are the minimum necessary to provide accurate results; therefore, equipment used must meet or exceed the listed specifications. Detailed operating instructions for test equipment are not contained in this procedure. Should additional operating information be needed, refer to the appropriate test-equipment instruction manual.

ADJUSTMENT SEQUENCE

Because of adjustment interaction, the adjustment steps must be performed in the order given.

ADJUSTMENT LOCATIONS

Adjustable component locations are shown in Figure 4-1. Only the adjustable components are illustrated in this figure.

PREPARATION

Before proceeding with each adjustment step, allow sufficient warm-up time for test equipment to stabilize (typically 20 minutes).

It is necessary to remove the top half of the Control Box cover to perform the Adjustment Procedure. Refer to the removal instructions in "Maintenance" (Section 6).

Table 4-1

Test Equipment Required

Item Number and Description	Minimum Specification	Purpose	Example of Suitable Test Equipment
1. Real Time Oscilloscope	Bandwidth: dc to least 100 MHz. Vertical deflection factor: 5 mV to 1 V. Two vertical channels.	Offset null, attenuation, and mid-frequency adjustments.	TEKTRONIX 7704A with 7A26 and 7B80 plug-ins.
2. Calibration Generator	Pulse rise time: 1 ns or less. Amplitude: 0.5 V or more into 50Ω. Repetition rate: 1 kHz to 100 kHz. Accuracy: ±0.25%.	Attenuation and mid-frequency adjustments.	TEKTRONIX PG 506.[a]

[a]Requires a TM 500-Series power-module mainframe.

Table 4-1

Test Equipment Required

Item Number and Description	Minimum Specification	Purpose	Example of Suitable Test Equipment
3. Precision Coaxial Cable	Impedance: 50Ω. Length: 36 in. Connectors: BNC.	Attenuation and mid-frequency adjustments.	Tektronix Part Number 012-0482-00.
4. Adapter	Connectors: subminiature-probe-tip-to-BNC male.	Attenuation and mid-frequency adjustments.	Tektronix Part Number 013-0195-00.
5. Termination	Impedance: 50Ω. Connectors: BNC.	Attenuation and mid-frequency adjustments.	Tektronix Part Number 011-0049-01.
6. BNC T	Impedance: 50Ω. Connectors: BNC.	Attenuation and mid-frequency adjustments.	Tektronix Part Number 103-0030-00.
7. Low-Reactance Alignment Tool	Length: 2-in shaft. Bit size: .050 in.	Offset null, attenuation, and mid-frequency adjustments.	Tektronix Part Number 003-0675-00.

PROCEDURE STEPS

1. Check/Adjust Offset Null

Equipment Required (see Table 4-1):

Oscilloscope (Item 1)
Alignment Tool (Item 7)

a. Connect the probe output to the test oscilloscope vertical input. Leave the probe tip free of all connections.

b. Set the probe's INT-EXT switch to INT.

c. Set test oscilloscope controls as follows:

Volts/Division	100 mV
Time/Division	1 ms
Input Coupling	DC
Bandwidth	Full Bandwidth

NOTE

Set the Volts/Division control to 10 mV if the oscilloscope you are using does not include the probe attenuation factor in its scale factor indication.

d. Center the trace on the screen.

e. CHECK – That the oscilloscope trace does not shift more than 1/2 of a minor division (10 mV referenced to the probe tip), while rotating the INPUT BIAS/OFFSET VOLTAGE control from one extreme to the other.

If the trace shift is within tolerance, proceed with the next adjustment. If the trace shift is excessive, proceed with part f.

f. ADJUST – R3017 (see Figure 4-1) for minimum trace shift while rotating the INPUT BIAS/OFFSET VOLTAGE control back and forth.

2. Check/Adjust Attenuation Accuracy and Mid-Frequency Response

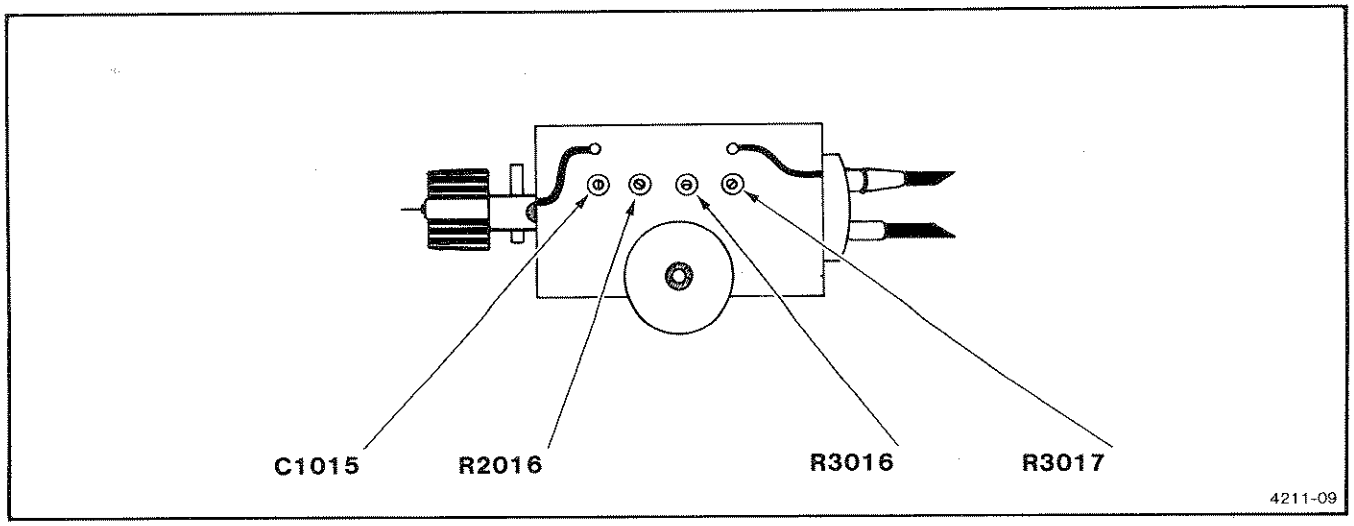


Figure 4-1. P6230 adjustment locations.

Equipment Required (see Table 4-1):

- Oscilloscope (Item 1)
- Calibration Generator (Item 2)
- Coaxial Cable (Item 3)
- Adapter (Item 4)
- Termination (Item 5)
- BNC T (Item 6)
- Alignment Tool (Item 7)

a. Set test oscilloscope controls as follows:

Ch 1 Volts/Division	100 mV

Ch 2 Volts/Division	10 mV
Display Mode	Alternate
Trigger Source	Mode
Time/Division	1 ms
Input Coupling	DC
Bandwidth	Full Bandwidth

b. Set the calibration generator controls as follows:

Amplitude	0.5 V
Period	1 ms
Mode	Standard Amplitude

c. Connect the Amplitude Output of the calibration generator to the channel 1 vertical input via the 50-Ω cable. (Do not use the 50-Ω termination.)

d. Set the oscilloscope triggering controls for a stable display and center the display on the screen.

e. Adjust the channel 1 gain control for an exact 5-division display.

f. Move the 50-Ω cable from the channel 1 vertical input to the channel 2 vertical input.

g. Change the amplitude of the calibration generator to 50 mV.

h. Adjust the channel 2 gain control for an exact 5-division display.

i. Remove the 50-Ω cable from the test setup. Install the P6230 on the channel 2 vertical input. Connect the probe power input connector to the oscilloscope probe power supply.

j. Set the probe's INT-EXT switch to INT.

k. Connect one end of the 50-Ω cable to the positive-going fast-rise output of the calibration generator. Connect the other end of the cable to one branch of the BNC T connector. Install the subminiature-probe-tip- to-BNC adapter on the other branch of the BNC T. Install the center leg of the BNC T on the channel 1 vertical input via the 50-Ω termination. Insert the probe tip into the probe-tip-to-BNC adapter.

l. Change the calibrator mode to Fast Rise.

m. Adjust the calibrator pulse amplitude for a 5-division channel 1 display.

n. Center the two traces on the screen.

o. CHECK — The amplitude of the channel 2 trace should be within ±3% (±0.15 division) of the amplitude of the channel 1 trace. The front-corner aberrations of the channel 2 trace should also match those of the channel 1 trace within ±3%.

If the amplitude and front corner aberrations are within tolerance, disconnect the test setup. If they are not, proceed with step p.

p. ADJUST — R3016, R2016, and C1015 for the best match between the channel 2 trace and the channel one trace. All three of these adjustments interact. R3016 and R2016 primarily control the attenuation of the probe, but they will also affect the front corner aberrations. C1015 adjusts the mid-frequency gain of the probe and will affect only the front corner response. The responses of the two channels should match within ±3%.

q. Disconnect the test setup.

THEORY OF OPERATION

INTRODUCTION

This section contains a functional description of the circuitry used in the P6230 Probe. The schematic diagram in "Replaceable Parts" (Section 7 of this manual) may be useful when reading the detailed circuit description. A functional block diagram is also provided (Figure 5-1).

GENERAL CIRCUIT DESCRIPTION

Figure 5-1 is a functional block diagram of the P6230. The P6230 divides the signal into two separate signal paths. The high-frequency path consists of the tip assembly, the cable assembly, R3015, C2010, and the 50-Ω termination. The probe tip assembly and the termination resistor form a voltage divider as in a conventional 50-Ω passive probe. The dc-to-mid-frequency path consists of the tip assembly, the cable assembly, R3015, R3010, R3016, inverting amplifier U1030B, differential amplifier U1030A, R2016, and R2015. The dc-to-mid-frequency path provides the input bias/offset voltage function.

DETAILED CIRCUIT DESCRIPTION

Operational amplifier U1030B, R1, R3015, R3010 and R3016, and R1020 and R3021 form an inverting amplifier with an adjustable bias provided at the amplifier + input by R2030 and R3034. In the dc and low-frequency range, the node at the junction of R3016, R3020, and R3021 is the virtual ground or null point for the inverting amplifier. At dc, the op amp will force the voltage at the null point to equal the adjustable bias voltage applied to the + input (pin 5 of U1030B). In the mid-frequency-to-high-frequency range, the node at the − input (pin 6 of U1030B) is an ac ground point.

R1020, R3021, and C2019 form a phase-lead network which forces op amp U1030B to compensate for

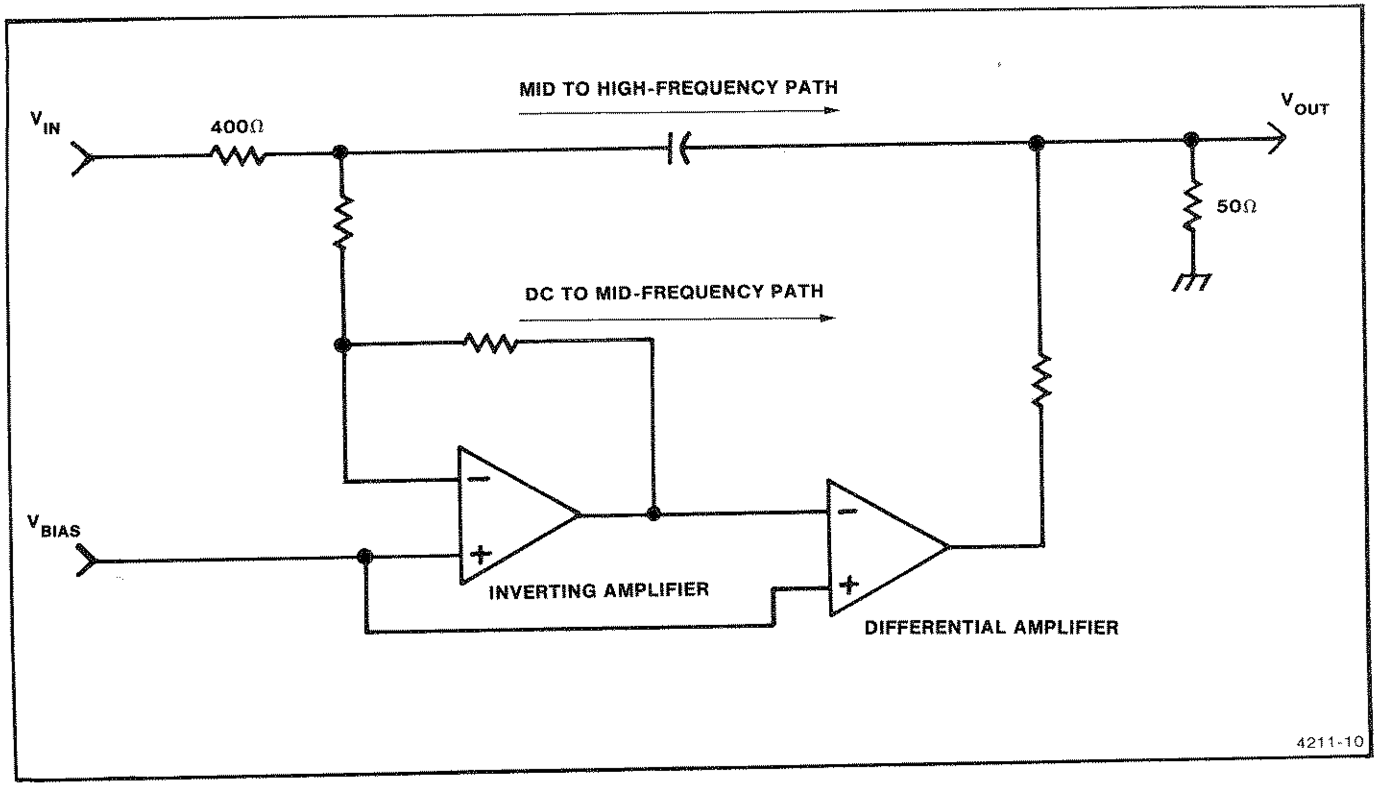


Figure 5-1. Functional block diagram.

the phase lag of op amp U1030A. CR3030 and CR3031 are clamping diodes which protect op amp U1030B from excessive probe input voltages, such as from electrostatic discharges.

U1030A, R1021, R1022, R3030 and R3017, and R1023 form a differential amplifier. The differential amplifier subtracts the input bias voltage at pin 5 of U1030B from the output of U1030B (pin 7), and re-inverts the dc-to-mid-frequency signal. R2015 and R2016 and the 50-Ω termination resistor form a voltage divider for the output of U1030A.

R3 is the probe internal 50-Ω termination resistor for use on oscilloscopes with only 1 MΩ input resistance. R4 is a probe-coding resistor, built into the BNC shell, which causes the readout circuitry of oscilloscopes equipped with probe-coding rings to advance the Volts/Division reading by 10X.

MAINTENANCE

INTRODUCTION

This section contains information for performing preventive maintenance, troubleshooting, and corrective maintenance on the P6230 Probe.

STATIC-SENSITIVE COMPONENTS

CAUTION

Static discharge can damage any semiconductor component in this probe.

This probe contains electrical components that are susceptible to damage from static discharge. See Table 6-1 for relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following standard precautions to avoid damage:

1. Minimize handling of static-sensitive components.

2. Transport and store static-sensitive components or assemblies in their original containers, on a metal rail, or on conductive foam. Label any package that contains static-sensitive assemblies or components.

3. Discharge the static electricity from your body by wearing a wrist strap while handling these components. Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel.

4. Nothing capable of generating or holding a static charge should be allowed on the work station surface.

5. Keep the component leads shorted together, whenever possible, with a shorting wire or conductive foam.

6. Pick up components by the body, never by the leads.

7. Do not slide the components over any surface.

8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.

9. Use a soldering iron that is connected to earth ground.

10. Use only special antistatic suction-type or antistatic wick-type desoldering tools.

Table 6-1

Relative Susceptibility to Static Discharge Damage

Semiconductor Classes	Approximate Susceptibility Level[a]
MOS or CMOS (most sensitive)	100-500 V.
ECL	200-500 V.
Schottky signal diodes	250 V.
Schottky TTL	500 V.
High-frequency bipolar transistors	400-600 V.
JFET	600-800 V.
Linear microcicuits	400-1000 V.
Low-power Schottky TTL	900 V.
TTL (least sensitive)	1200 V.

[a]Voltage discharged from a 100 pF capacitor through a 100-Ω resistor.

PREVENTIVE MAINTENANCE

Preventive maintenance consists primarily of cleaning and visual inspection. When performed on a regular basis, preventive maintenance can prevent instrument breakdown and may improve instrument reliability. The frequency of maintenance depends on the severity of the environment to which the probe is subjected. A convenient time to perform preventive maintenance is just before performing an Adjustment Procedure.

CLEANING

CAUTION

Avoid the use of chemical cleaning agents which may damage the plastics and circuit board used in the probe. In particular, avoid chemicals which contain benzene, toluene, xylene, acetone, or similar solvents. For additional information on recommended cleaning agents, consult your Tektronix Service Center or representative.

Exterior

Loose dust accumulated on the outside of the probe can be removed with a soft cloth or a small brush. Dirt which remains can be removed with a soft cloth dampened in a mild detergent and water solution. Do not use abrasive cleaners.

Interior

Cleaning the interior of the probe should only be occasionally necessary. Normally, the probe compensation box circuit board will not require cleaning unless a cover has been removed for an extended period of time. The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air (about 9 lb/sq. in). Remove any dirt which remains with a soft brush or a cloth dampened with a nonresidue-type cleaner, preferably isopropyl alcohol. A cotton-tipped applicator is useful for cleaning in narrow spaces or for cleaning more delicate circuit components.

VISUAL INSPECTION

Occasionally inspect the P6230 for such defects as broken connections, damaged parts, bent leads, and heat-damaged components. Overheating usually indicates other trouble in the probe, therefore, the cause of overheating must be corrected to prevent recurrence of the damage.

SEMICONDUCTOR CHECKS

Periodic checking of semiconductors is not recommended. The best check of semiconductor performance is proper operation of the probe.

TROUBLESHOOTING

The following information is provided to facilitate troubleshooting the probe. An understanding of circuit operation is often helpful in locating troubles. Refer to "Theory of Operation" (Section 5) for this information.

Table 6-2 lists the equipment useful for troubleshooting the P6230. If the particular items listed are not available, substitutions may be made with similar test equipment which meet or exceed the listed specifications.

Table 6-3 is a listing of possible fault indications and their probable causes.

Table 6-2

Troubleshooting Equipment

Description	Minimum Specification	Example
1. Real time oscilloscope	Bandwidth: dc to about 15 MHz. Vertical deflection factor: 5 mV to 1 V.	TEKTRONIX 7704A with 7A26 and 7B80 plug-ins.
2. Digital Multimeter	Voltmeter; 0 to 20 V dc range, 0.15% accuracy. Ohmmeter; 0 to 2 MΩ range.	TEKTRONIX DM 502A.

Table 6-3

Fault Indication and Probable Cause

Fault Indication	Probable Cause	Corrective Action
Wrong Attenuation Ratio	1. INT-EXT switch in wrong position.	Set INT-EXT switch to INT for loads ≥ 500kΩ or EXT for loads of 50Ω.
	2. Faulty INT-EXT switch.	Replace INT-EXT switch.
	3. Input signal exceeds probe dynamic range.	Reduce signal amplitude.
	3. Defective probe tip assembly.	Replace probe tip assembly.
DC and mid-frequency attenuation wrong. HF attenuation correct.	Attenuation and mid-frequency adjustments incorrect.	See "Adjustment Procedure."
DC and mid-frequency portion of signal missing or severely attenuated.	1. Defective power supply.	Check + and −15 volt supply. Replace or repair if defective.
	2. U1030 defective.	Replace U1030.
	3. R3016 or R2016 defective.	Check and replace if necessary.

Table 6-3 (cont)

Fault Indication and Probable Cause

Fault Indication	Probable Cause	Corrective Action
HF portion of signal missing or severely attenuated. DC and mid-frequency response correct.	C2010 defective.	Replace C2010.
Mid-frequency gain out specification.	C1015 misadjusted or defective.	See "Adjustment Procedure." Replace C1015 if necessary.
Rise time out of specification or excessive hf aberrations.	1. Defective probe tip assembly.	Replace probe tip assembly.
	2. R3015 defective.	Check and replace if necessary.
	3. C2010 defective.	Replace C2010.
No signal or intermittent signal.	1. Broken or unsoldered wire, connection, or component.	Visually check for damage and repair any found.
	2. Defective cable assembly.	Check for shorts or opens and replace if necessary.

Table 6-3 (cont)

Fault Indication and Probable Cause

Fault Indication	Probable Cause	Corrective Action
	3. Signal path shorted to ground.	Visually check all probe cable connectors and circuit board connectors. Repair or replace if necessary.
	4. R3015 defective.	Check and replace if necessary.
	5. Defective probe tip assembly.	Replace probe tip assembly.
Input bias/offset voltage feature does not work or is out of specifcation.	1. U1030 defective.	Replace U1030.
	2. R2030 defective.	Check and replace if necessary.
	3. Power supply is defective or out of specification.	Check power supply and repair or replace if necessary.
	4. C1010 defective.	Replace C1010.

SCHEMATIC DIAGRAM AND CIRCUIT BOARD ILLUSTRATIONS

A schematic diagram is located in the "Replaceable Parts" section of this manual. The component number and electrical value of each component are shown on the diagram. An illustration of the probe circuit board, showing the location of each mounted component, is on the page facing the schematic diagram.

COLOR CODES AND MARKINGS

Resistors used in the probe are either composition or precision metal-film types. They are color coded with the EIA color code, but some metal-film resistors may have the value printed on the body. Refer to Figure 6-2 or color-coding definition.

The capacitance value of common disc and some small electrolytic capacitors is marked on the side of the component body.

The cathode end of each diode is indicated by either a stripe, a series of stripes, or a dot.

SEMICONDUCTOR LEAD CONFIGURATION

Figure 6-1 shows the lead configuration of the IC used in the probe control box.

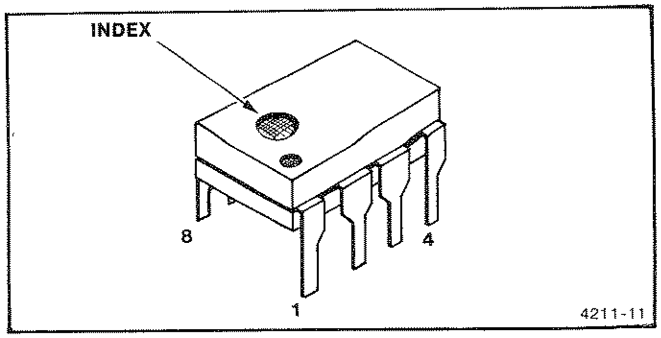
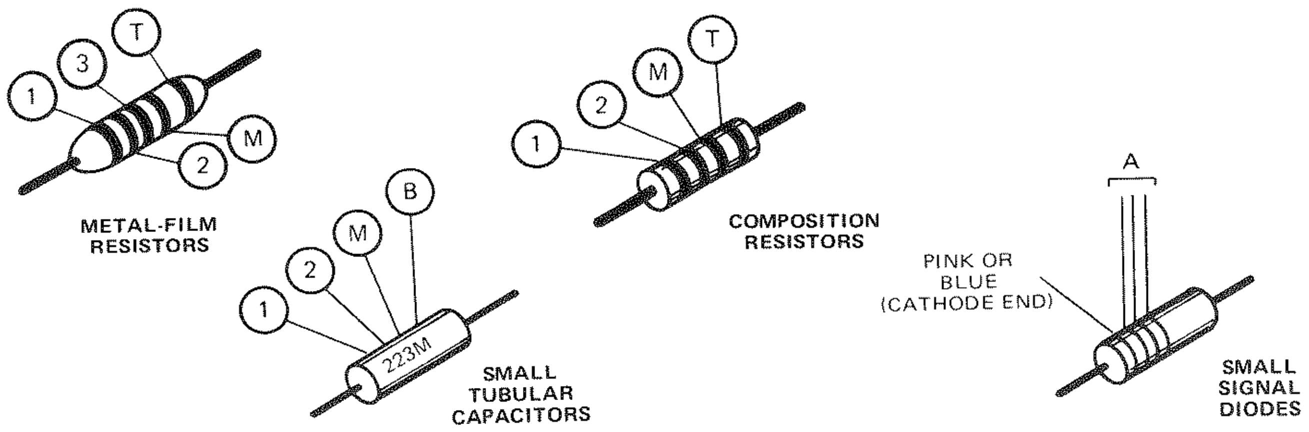


Figure 6-1. Lead configuration of IC.

TROUBLESHOOTING TECHNIQUES

The following techniques are arranged in an order that checks the simple possibilities before proceeding with extensive troubleshooting. The first few checks ensure proper connection, operation, and calibration. If the trouble is not located by these checks, the remaining steps



(A) COLORS IDENTIFY SIGNIFICANT DIGITS IN TEKTRONIX PART NUMBER (E.G. BROWN, GRAY, GREEN STRIPES INDICATE PART NUMBER 152-0185-00)

(1) (2) and (3) 1ST, 2ND, AND 3RD SIGNIFICANT FIGS.

(M) MULTIPLIER (T) TOLERANCE;

(TC) TEMPERATURE COEFFICIENT.

(B) TOLERANCE; F=±1%, J=5%, K=10%, M=20%

(T) AND/OR (TC) COLOR CODE MAY NOT BE PRESENT ON SOME CAPACITORS;

3642-20

Figure 6-2. Color code for resistors and capacitors.

COLOR	SIGNIFICANT FIGURES	RESISTORS (Ω)		CAPACITORS (pF)		
		MULTIPLIER	TOLERANCE	MULTIPLIER	TOLERANCE	
					Over 10 pF	Under 10 pF
BLACK	0	1	---	1	±20%	±2 pF
BROWN	1	10	±1%	10	±1%	±0.1 pF
RED	2	10^2 or 100	±2%	10^2 or 100	±2%	---
ORANGE	3	10^3 or 1 K	±3%	10^3 or 1000	±3%	---
YELLOW	4	10^4 or 10 K	±4%	10^4 or 10,000	+100% −9%	---
GREEN	5	10^5 or 100 K	±½%	10^5 or 100,000	±5%	±0.5 pF
BLUE	6	10^6 or 1 M	±¼%	10^6 or 1,000,000	---	---
VIOLET	7	---	±1/10%	---	---	---
GRAY	8	---	---	10^{-2} or 0.01	+80% −20%	±0.25 pF
WHITE	9	---	---	10^{-1} or 0.1	±10%	±1 pF
GOLD	–	10^{-1} or 0.1	±5%	---	---	---
SILVER	–	10^{-2} or 0.01	±10%	---	---	---
NONE	–	---	±20%	---	±10%	±1 pF

3642-28

Figure 6-2. Color code for resistors and capacitors (cont).

should aid in isolating the defective component. Replace defective components using the "Corrective Maintenance" procedures in this section.

1. Check Control Settings

Incorrect control settings can indicate a trouble that does not exist. If there is any question about the correct function or operation of any control, refer to Section 2, "Operating Instructions".

2. Check Associated Equipment

Associated equipment at either the input or output of the probe may be defective. A signal you expect to see might not exist or might be distorted at the point you are testing. If you are using the probe with an oscilloscope the vertical amplifier may be defective or the vertical controls may be misadjusted.

3. Check Calibration

An out-of-calibration condition of either the probe or the test oscilloscope can cause an apparent error in a measurement.

4. Visual Check

Many problems can be located visually. Check for broken wires, damaged connections, and damaged circuit boards. If you discover a heat-damaged component, find the cause of overheating to prevent recurrence of the problem.

5. Refer to Table 6-3.

Table 6-3 lists some possible malfunctions and probable causes.

6. Check Waveforms and Voltages

Typical voltages are shown on the schematic diagram in Section 7.

CORRECTIVE MAINTENANCE

Corrective maintenance consists of replacing a defective component or subassembly. Special techniques required to replace components are given here.

MAINTENANCE PRECAUTIONS

To reduce the possibility of personal injury or probe damage, observe the following precautions:

WARNING

To prevent electric shock and shorting of components, disconnect the power connector from the power source before disassembling the probe and before removing or installing any component.

CAUTION

Do not use excessive heat when soldering or unsoldering, since circuit and component damage can result.

OBTAINING REPLACEMENT PARTS

Standard Parts

Most electrical and mechanical parts can be obtained through your local Tektronix Field Office or representative. However, you should be able to obtain many of the standard electronic components from a local commercial source in your area. Before you purchase or order a part from a source other than Tektronix, Inc., please check the Replaceable Electrical Parts List for the proper value, rating, tolerance, and description.

NOTE

Physical size and shape of a component may affect instrument performance, particularly at high frequencies. Always use direct-replacement components, unless you know that a substitute will not degrade instrument performance.

Special Parts

In addition to standard electronic components, some special components are used in this instrument which are manufactured or selected by Tektronix, Inc. to meet specific performance requirements. Others are manufactured for Tektronix, Inc. in accordance with our specifications (see Cross Index-Manufacturers Code Number to Manufacturer in the "Replaceable Parts List" sections). Most of the mechanical parts used in the probe have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts

When ordering replacement parts from Tektronix, Inc., include all of the following information to insure receiving the proper parts.

1. Instrument type (include modification or option numbers).

2. A description of the part (if electrical, include the circuit number).

3. Tektronix part number.

SOLDERING TECHNIQUES

WARNING

To prevent electric shock and shorting of components, always disconnect the power connector from the power source before soldering.

Use ordinary 60/40 solder and a 15 W pencil-type soldering iron for most soldering. If a soldering iron with higher wattage rating is used on etched circuit boards, excessive heat can cause the etched circuit wiring to separate from the board base material.

The following technique should be used when soldering on a circuit board.

1. Grip component lead with long-nose pliers. Touch soldering iron to lead at solder connection. Do not lay iron directly on board.

2. When solder begins to melt, pull lead out gently. This should leave a clean hole in the board. If not, the hole can be cleaned by reheating solder and placing a sharp object–such as a toothpick into the hole to clean it out. A vacuum-type desoldering tool also can be used for this purpose.

3. Bend leads of new component to fit holes in board. If component is replaced while board is mounted in the probe, cut leads so they just protrude through board. Insert leads into holes in board with component firmly seated against board (or as positioned originally). If it does not seat properly, heat solder and gently press component into place.

4. Touch the iron to the connection and apply a small amount of solder to make a firm solder joint. To protect heat-sensitive components, hold the lead between the component body and the solder joint with a pair of long-nose pliers or other heat sink.

5. Clip excess lead that protrudes through board (if not clipped in step 3).

6. Clean the area around the solder connection, being careful not to remove information printed on the board.

PROBE DISASSEMBLY

PROBE TIP REPLACEMENT

To remove the probe tip, first unscrew the light-gray probe-body shell and slide off the grounding collar (refer to Figure 2-2). Then unscrew the probe tip from the cable assembly. The probe tip for the P6230 has small plastic end-pieces that are color coded yellow at the tip end and blue at the cable end to aid in distinguishing the P6230 tip from other subminiature probe tips. To install a replacement probe tip, simply reverse the procedure.

Control Box Disassembly

WARNING

To prevent electric shock or shorting of components, disconnect the power connector from the power source before removing the covers from the Control Box.

The following procedure should be used when replacing components or assemblies in the Control Box.

1. Remove the four screws holding the top half of the Control Box cover. (Refer to Figure 6-3.) Remove the top half cover.

2. Remove the two bottom-cover screws nearest the cable assembly.

3. Unplug either end of the blue coaxial cable.

CAUTION

Do not attempt to unplug the gray coaxial cable from its circuit-board socket. The center conductor of the gray cable is soldered to the circuit board and may be damaged.

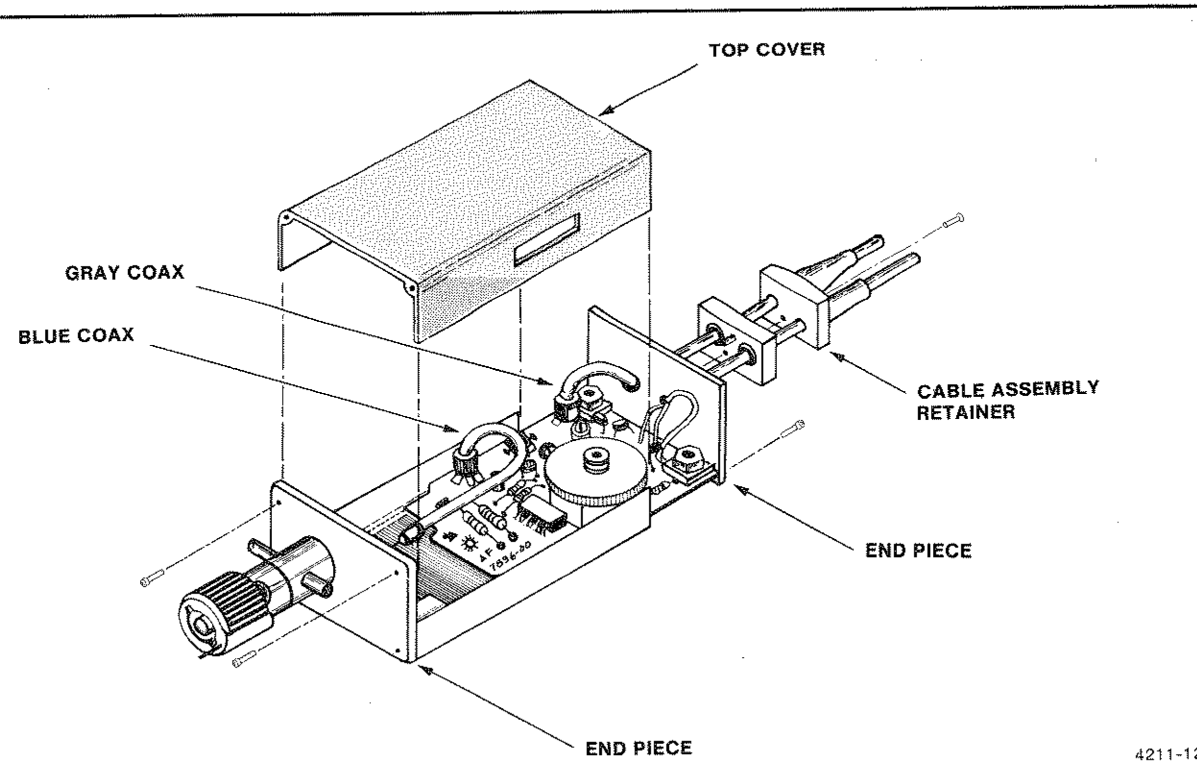


Figure 6-3. Disassembly of Control Box.

4. The circuit board (with its attached cable assembly) may now be slid away from the bottom half of the Control Box cover by applying a steady, even pull to the two Control Box end-pieces. Individual components may now be removed from the circuit board.

Cable Assembly Replacement

The power and signal cables are replaceable as a complete assembly. To remove the cable assembly, first follow the four steps given above to gain access to both sides of the circuit board. Then proceed as follows.

1. Unsolder and identify for later installation the four power cable wires and the center conductor of the gray signal cable.

2. Unplug the gray signal cable from its circuit-board connector.

3. Remove the screw holding the plastic cable-assembly retainer to the Control Box end-piece. (See Figure 6-3.)

Input Power Connector Replacement

The input power connector may be replaced as a separate item. Simply unscrew the connector shell and unsolder the three power cable wires. Refer to Figure 6-4 for wire location when installing the new connector.

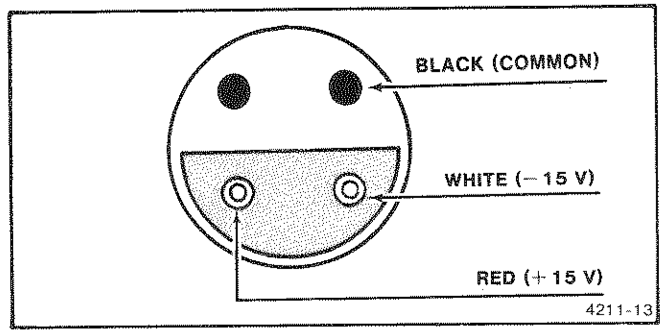


Figure 6-4. Input power connector pins.

INT-EXT Switch Replacement

1. Remove the four screws holding the top half of the Control Box cover. (Refer to Figure 6-3.) Remove the top half cover.

2. Unplug the blue signal coaxial cable from the BNC connector.

3. Using a 7/16-inch open-end wrench, loosen the BNC connector shell and carefully remove it (see Figure 6-5).

5. Grasp the INT-EXT switch actuator and pull to remove (see Figure 6-5). Note orientation of the clip end.

4. Grasp the white plastic piece just exposed and pull to remove (see Figure 6-5).

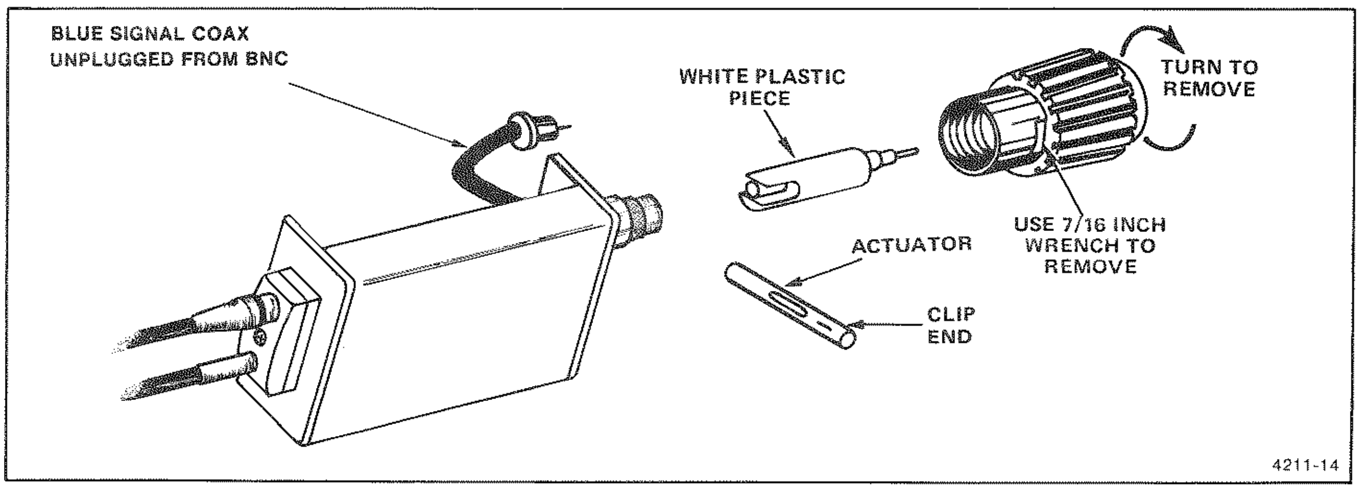


Figure 6-5. INT-EXT switch removal.

NOTE

When reinstalling the switch actuator, be sure the clip end is toward the side of the control box with the INPUT BIAS/OFFSET VOLTAGE control.

READJUSTMENT AFTER REPAIR

After any electrical component has been replaced, complete the "Performance Check Procedure" (Section 3) to verify that the probe is within specification limits. If adjustment is necessary, perform the appropriate "Adjustment Procedure" (Section 4).

1. Obtain a corrugated cardboard carton having inside dimensions of no less than 2 inches more than probe dimensions to allow cushioning. Use a carton having a test strength of at least 175 pounds.

2. Description of the service required.

Required Reshipment Information

If the probe is to be shipped to a Tektronix Service Center for service or repair, attach a tag (before packaging) that contains the following information.

INSTRUMENT REPACKING

To repackage the probe, use the original carton in which your probe was shipped. If the original packing is unfit for use or is not available, repackage the probe as follows.

1. Owner's name and address, with the name of an individual at your firm that can be contacted.

2. Surround the probe with protective polyethylene sheeting.

3. Cushion the probe on all sides by tightly packing dunnage or urethane foam between carton and probe, allowing 2 inches on all sides.

4. Seal carton with shipping tape or industrial stapler.

DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μF).

Resistors = Ohms (Ω).

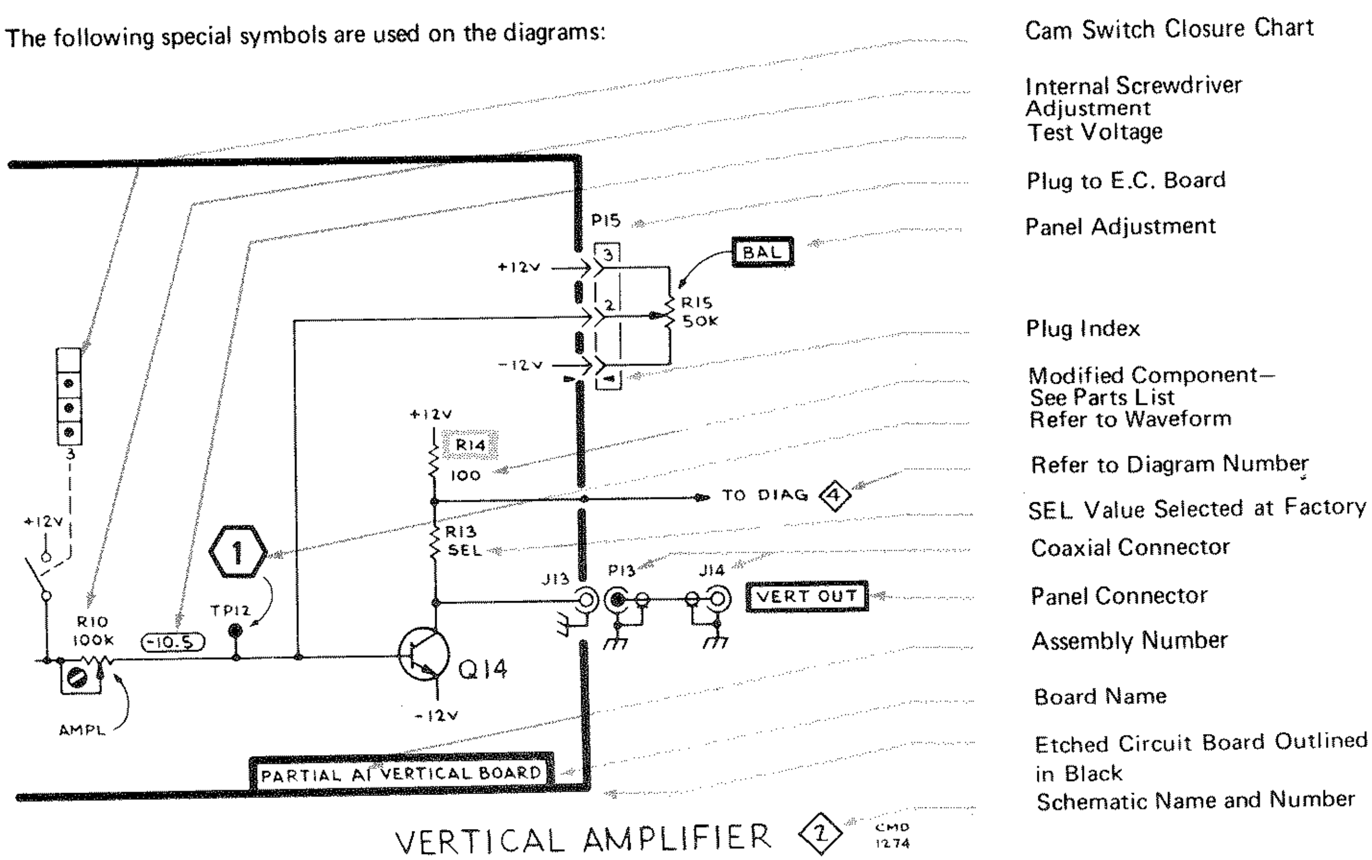
Symbols used on the diagrams are based on USA Standard Y32.2-1967.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)
AT	Attenuator, fixed or variable
B	Motor
BT	Battery
C	Capacitor, fixed or variable
CB	Circuit breaker
CR	Diode, signal or rectifier
DL	Delay line
DS	Indicating device (lamp)
E	Spark Gap
F	Fuse
FL	Filter
H	Heat dissipating device (heat sink, heat radiator, etc.)
HR	Heater
HY	Hybrid circuit
J	Connector, stationary portion
K	Relay
L	Inductor, fixed or variable
LR	Inductor/resistor combination
M	Meter
P	Connector, movable portion
Q	Transistor or silicon-controlled rectifier
R	Resistor, fixed or variable
RT	Thermistor
S	Switch
T	Transformer
TC	Thermocouple
TP	Test point
U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
V	Electron tube
VR	Voltage regulator (zener diode, etc.)
Y	Crystal
Z	Phase shifter

The following special symbols are used on the diagrams:



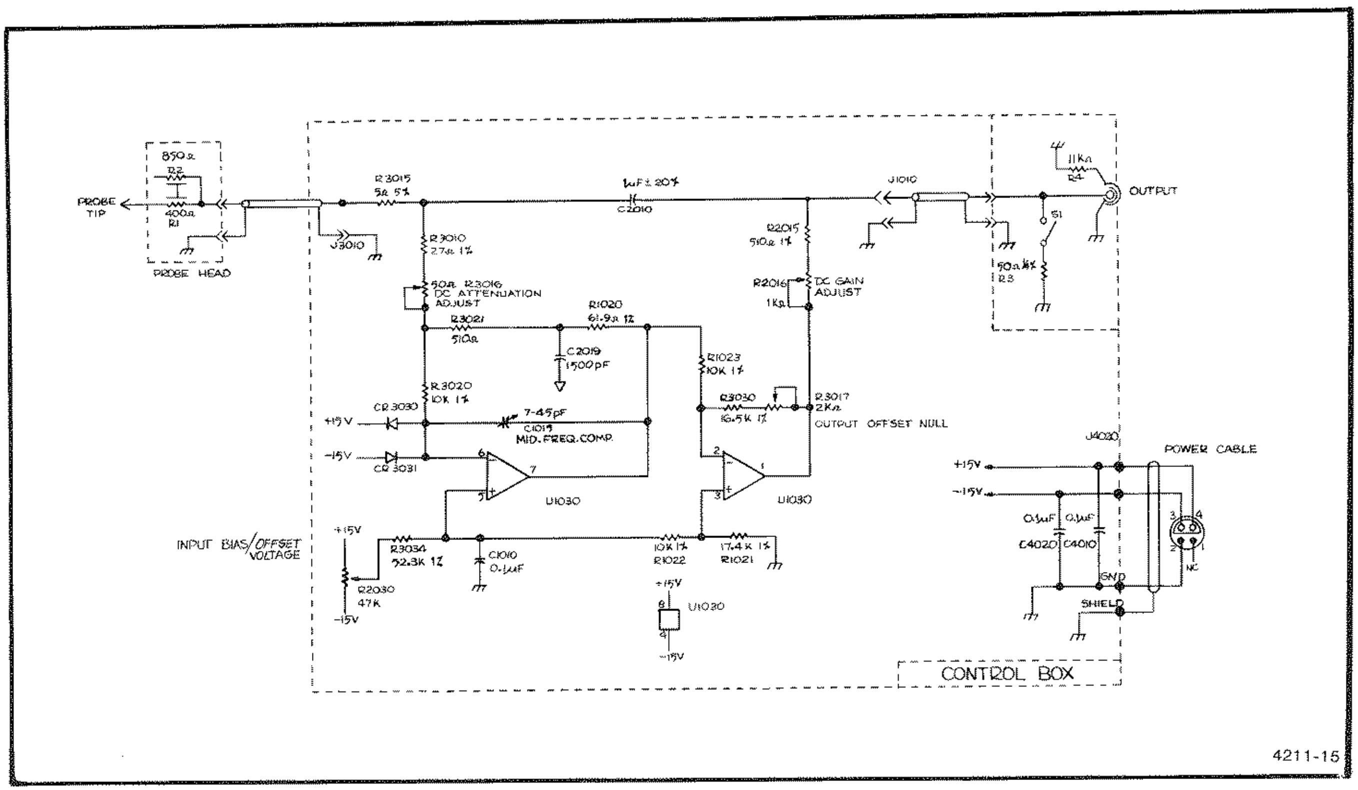


Figure 7-1. Schematic diagram for the P6230.

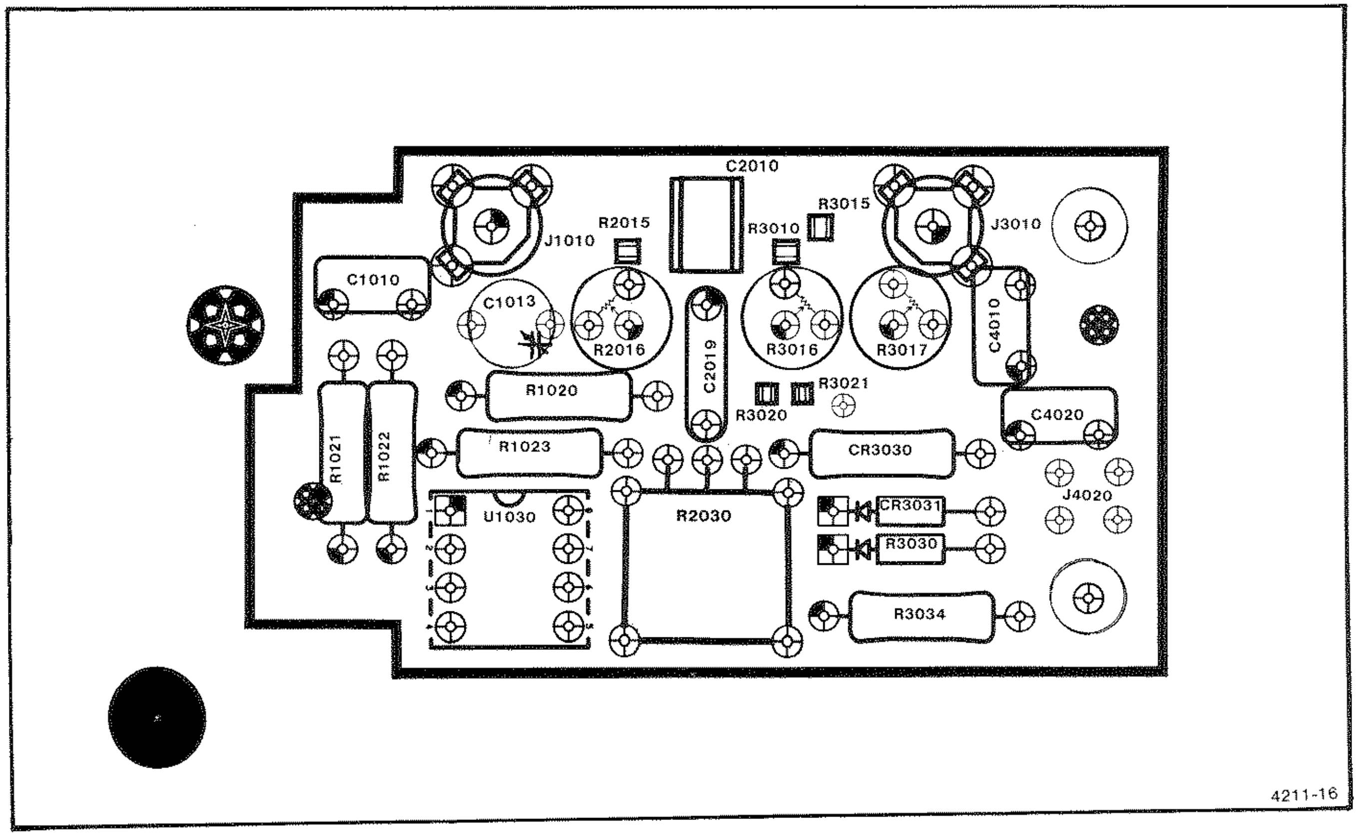


Figure 7-2. P6230 circuit board.

REPLACEABLE PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 *Name & Description*

Assembly and/or Component
Attaching parts for Assembly and/or Component
\- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
\- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
\- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000GL	LEMO USA INC.	335 TESCONI CIRLE	SANTA ROSA, CA 95401
01295	TEXAS INSTRUMENTS, INC., SEMICONDUCTOR GROUP	P O BOX 5012, 13500 N CENTRAL EXPRESSWAY	DALLAS, TX 75222
18324	SIGNETICS CORP.	811 E. ARQUES	SUNNYVALE, CA 94086
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
24931	SPECIALITY CONNECTOR CO., INC.	2620 ENDRESS PLACE	GREENWOOD, IN 46142
51642	CENTRE ENGINEERING INC.	2820 E COLLEGE AVENUE	STATE COLLEGE, PA 16801
52262	B AND H ELECTRONICS, INC., DBA MICRO COMPONENTS ASSOCIATES	202 E STEVENS ST., SUITE 6	SANTA ANA, CA 92707
57668	R-OHM CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
59660	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705
70276	ALLEN MFG. CO.	P. O. DRAWER 570	HARTFORD, CT 06101
72982	ERIE TECHNOLOGICAL PRODUCTS, INC.	644 W. 12TH ST.	ERIE, PA 16512
73138	BECKMAN INSTRUMENTS, INC., HELIPOT DIV.	2500 HARBOR BLVD.	FULLERTON, CA 92634
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
73899	JFD ELECTRONICS COMPONENTS CORP.	PINETREE ROAD	OXFORD, NC 27565
78189	ILLINOIS TOOL WORKS, INC. SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	670-7506-00			CKT BOARD ASSY:PROBE	80009	670-7506-00
A1C1010	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
A1C1015	281-0158-00			CAP.,VAR,CER DI:7-45PF,50V	73899	DVJ-5006
A1C2010	283-0209-00			CAP.,FXD,CER DI:1UF,20%,50V	51642	UC35050Z5U105MPS
A1C2019	283-0114-00			CAP.,FXD,CER DI:0.0015UF,5%,200V	59660	534 Y5D0 152 J
A1C4010	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
A1C4020	283-0111-00			CAP.,FXD,CER DI:0.1UF,20%,50V	72982	8121-N088Z5U104M
A1CR3030	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1CR3031	152-0141-02			SEMICOND DEVICE:SILICON,30V,150MA	01295	1N4152R
A1J1010	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A1J3010	131-1003-00			CONN,RCPT,ELEC:CKT BD MT,3 PRONG	80009	131-1003-00
A1R1020	321-0077-00			RES.,FXD,FILM:61.9 OHM,1%,0.125W	91637	MFF1816G61R90F
A1R1021	321-0312-00			RES.,FXD,FILM:17.4K OHM,1%,0.125W	91637	MFF1816G17401F
A1R1022	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A1R1023	321-0289-00			RES.,FXD,FILM:10K OHM,1%,0.125W	91637	MFF1816G10001F
A1R2015	307-0515-00			RES.,FXD,FILM:510 OHM,1%,0.075W	52262	MREC511FZ
A1R2016	311-0635-00			RES.,VAR,NONWIR:1K OHM,10%,0.5%,0.5W	73138	82P-6-2-102K
A1R2030	311-2215-01			RES.,VAR,NONWIR:CKT BD,47K OHM,20%,0.5W	80009	311-2215-01
A1R3010	307-0514-00			RES.,FXD,FILM:27 OHM,1%,0.075W	52262	MCRA270FYZ
A1R3015	307-0552-00			RES.,FXD,FILM:5 OHM,5%,0.075 W	52262	MCRA5R0JZ
A1R3016	311-0643-00			RES.,VAR,NONWIR:50 OHM,10%,0.50W	73138	82-33-2
A1R3017	311-0609-00			RES.,VAR,NONWIR:2K OHM,10%,0.50W	73138	82-26-1
A1R3020	307-0797-00			RES.,FXD,FILM:10K OHM,10%,0.05W	52262	MCRA103KY
A1R3021	307-0515-00			RES.,FXD,FILM:510 OHM,1%,0.075W	52262	MREC511FZ
A1R3030	321-0310-00			RES.,FXD,FILM:16.5K OHM,1%,0.125W	91637	MFF1816G16501F
A1R3034	321-0358-00			RES.,FXD,FILM:52.3K OHM,1%,0.125W	91637	MFF1816G52301F
A1U1030	156-1272-00			MICROCIRCUIT,LI:DUAL OPERATIONAL AMPLIFIER	18324	NE5532 FE-11B

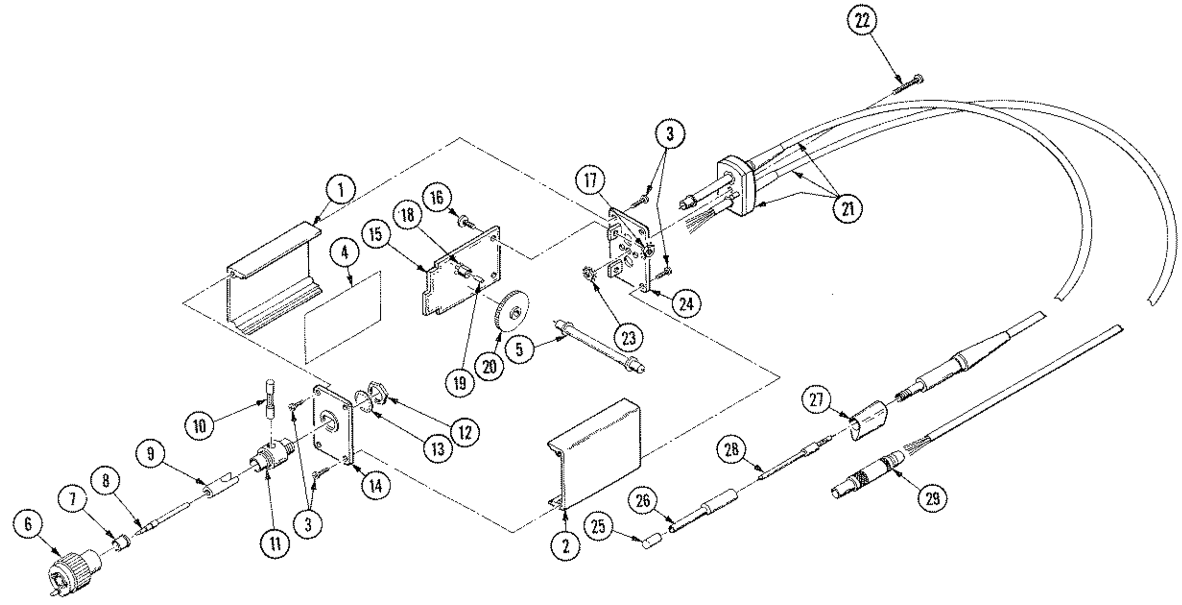
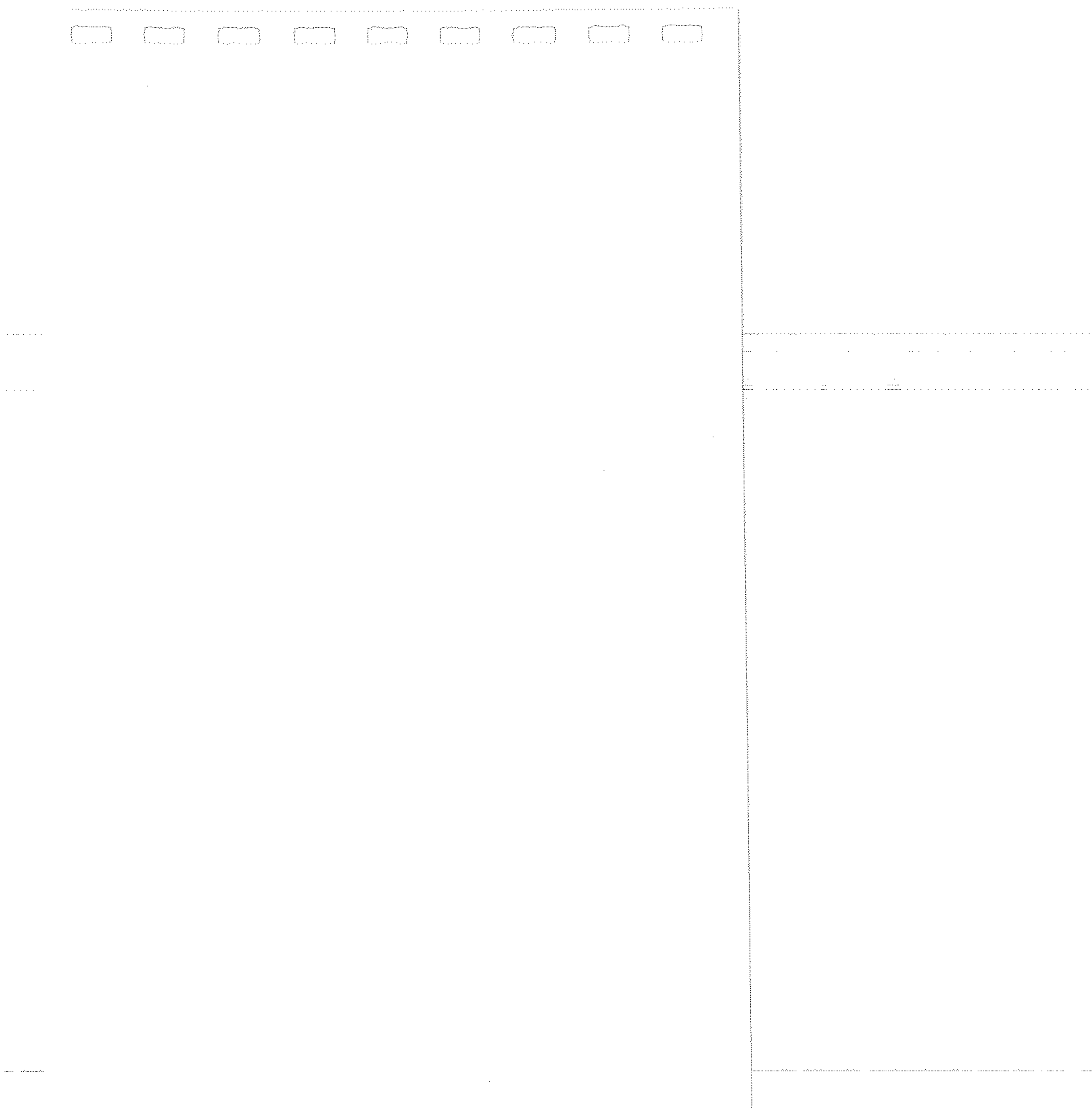


Figure 7-3 Exploded View

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
7-3-	010-6230-01			1	PROBE,VOLTAGE:P6230,10X,W/ACCESSORIES	80009	010-6230-01
	010-6230-00			1	. PROBE,VOLTAGE:P6230,10X	80009	010-6230-00
3-1	380-0708-00			1	. . HSG HALF,COMP B		
-2	380-0709-00			1	. . HSG HALF,COMP B		
					(ATTACHING PARTS FOR BOTH HALVES)		
-3	211-0062-00			8	. . SCREW,MACHINE:2-56 X 0.312,PNH,STL	83385	OBD
					- - - * - - -		
-4	342-0650-00			1	. . INSULATOR,PLATE:BOTTOM HOUSING		
-5	175-3737-00			1	. . CABLE ASSY,RF:50 OHM COAX,2.5 L,6-N	80009	175-3737-00
-6	131-1799-03			1	. . CONN,RCPT,ELEC:BNC,FEM W/READOUT 10X	80009	131-1799-03
-7	358-0072-00			1	. . INSULATOR,BSHG:	80009	358-0072-00
-8	131-1893-04			1	. . CONTACT,ELEC:W/136-0252-00	80009	131-1893-04
-9	342-0337-00			1	. . INSULATOR,BSHG:0.084 ID X 0.66 L,TEFLON	80009	342-0337-00
-10	262-0998-01			1	. . SWITCH,ASSY:	80009	262-0998-01
-11	131-2973-00			1	. . CONN,RCPT,ELEC:SCREW TYPE,1 FEMALE		
					(ATTACHING PARTS)		
-12	210-0413-00			1	. . NUT,PLAIN,HEX.:0.375-32 X 0.50 INCH,STL	73743	3145-402
-13	210-0012-00			1	. . WASHER,LOCK:INTL,0.375 ID X 0.50" OD STL	78189	1220-02-00-0541C
					- - - * - - -		
-14	333-3041-00			1	. . PANEL,REAR:	80009	333-3041-00
-15	----- -----			1	. . CKT BOARD ASSY:PROBE(SEE A1 REPL)		
					(ATTACHING PARTS)		
-16	211-0008-00			2	. . SCREW,MACHINE:4-40 X 0.250,PNH,STL,CD PL	83385	OBD
-17	210-0586-00			2	. . NUT,PL,ASSEM WA:4-40 X 0.25,STL	83385	OBD
					- - - * - - -		
	----- -----			-	. . CKT BOARD ASSY INCLUDES:		
-18	----- -----			2	. . . CONN,RCPT,ELEC:CKT BD MT,3 PRONG		
	----- -----			-	. . . (SEE A1J1010,A1J3010 REPL)		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
7-3-19	136-0252-07			1	. . . SOCKET,PIN CONN:W/O DIMPLE	22526	75060-012
-20	366-0371-00			1	. . KNOB:BLACK,0.116 ID X 0.92 OD X 0.235 H		
					(ATTACHING PARTS)		
	213-0140-00			1	. . SETSCREW:2-56 X 0.94 INCH,HEX SOC STL	70276	OBD
					- - - * - - -		
-21	175-8601-00			1	. . CABLE ASSY,RF:50 OHM COAX,59.8 L,1.3 METER	80009	175-8601-00
					(ATTACHING PARTS)		
-22	211-0061-00			1	. . SCREW,MACHINE:4-40 X 0.50,FILH,STL,CD PL	83385	OBD
-23	210-0586-00			1	. . NUT,PL,ASSEM WA:4-40 X 0.25,STL	83385	OBD
					- - - * - - -		
-24	333-0098-00			1	. . PANEL,REAR:	80009	333-0098-00
-25	----- -----			1	. . COVER,PROBE TIP:POLTHN,NATURAL	80009	200-2747-00
	----- -----			-	. . (AVAILABLE ONLY IN PACKAGES OF 10,		
	----- -----			-	. . ORDER P/N 200-2747-01)		
-26	204-0925-01			1	. . BODY SHL,PROBE:	80009	204-0925-01
-27	343-1003-01			1	. . COLLAR,GND:	80009	343-1003-01
-28	206-0279-00			1	. . TIP ASSY,PROBE:10X	80009	206-0279-00
-29	131-0778-00			1	. . CONN,PLUG,ELEC:LEMO,2 MALE,2 FEMALE	000GL	FO.304 NYLS/4.2



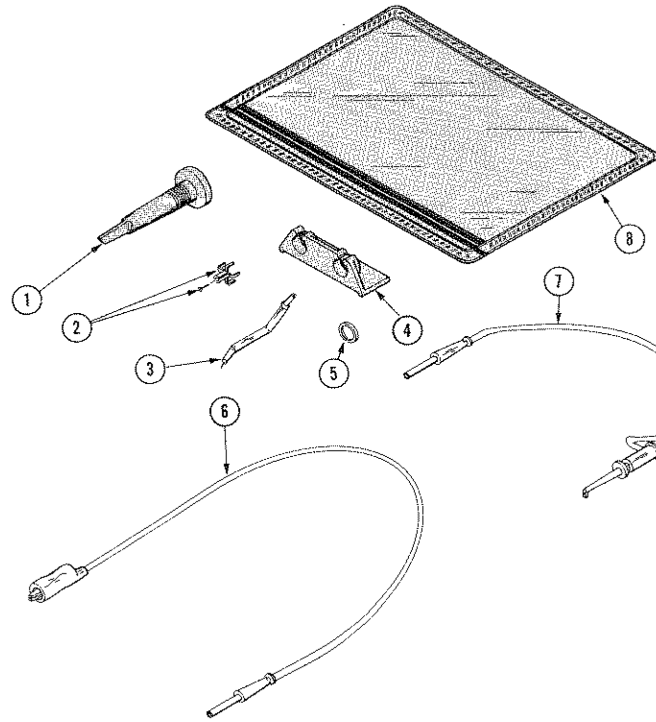


Figure 7-4 Standard Accessories

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
					STANDARD ACCESSORIES		
7-4-	070-4211-00			1	MANUAL,TECH:INSTRUCTION	80009	070-4211-00
-1	013-0208-00			1	TIP,PROBE:RETRACTABLE HOOK	80009	013-0208-00
-2	131-2766-03			1	CONN,PROBE:W/SOCKET,DATA SHEET	80009	131-2766-03
-3	195-4240-00			1	LEAD,ELEC:0.025 DIA,COPPER,2.3 L	80009	195-4240-00
-4	352-0687-00			1	HOLDER,PROBE:SLATE GRAY	80009	352-0687-00
-5	334-2794-01			2	BAND,MARKER:0.371 DIA,WHITE,PLASTIC	80009	334-2794-01
	334-2794-03			2	BAND,MARKER:0.371 DIA,GRAY,PLASTIC	80009	334-2794-03
	334-2794-06			2	BAND,MARKER:0.371 DIA,RED,PLASTIC	80009	334-2794-06
	334-2794-07			2	BAND,MARKER:0.371 DIA,GREEN,PLASTIC	80009	334-2794-07
-6	195-1870-00			1	LEAD,ELECTRICAL:26 AWG,8.812 L	80009	195-1870-00
-7	195-4104-00			1	LEAD,ELECTRICAL:23 AWG,6.3 L	80009	195-4104-00
-8	016-0708-00			1	POUCH,ASSY:		

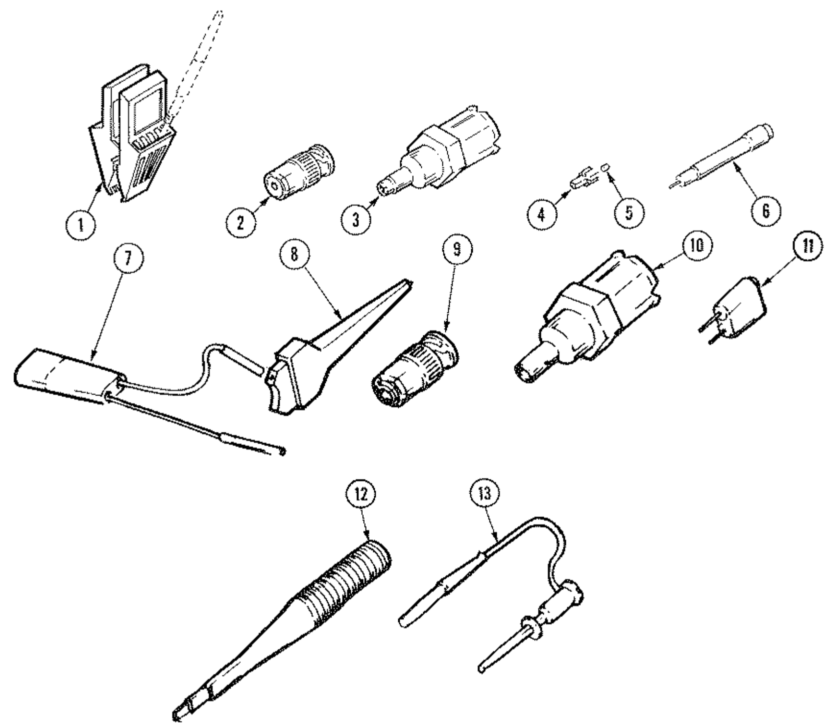


Figure 7-5 Optional Accessories

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Serial/Model No. Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
					OPTIONAL ACCESSORIES		
	THE FOLLOWING COMMONLY USED OPTIONAL ACCESSORIES ARE COMPATIBLE WITH THE P6230 PROBE. FOR A COMPLETE LIST OF AVAILABLE PROBE ACCESSORIES, CONSULT A TEKTRONIX PRODUCT CATALOG OR YOUR NEAREST TEKTRONIX FIELD OFFICE OR REPRESENTATIVE.						
7-5-1	013-0197-00				ADAPTER ASSY:PROBE TO DIP	80009	013-0197-00
-2	013-0195-00				ADAPTER,CONN:BNC TO PROBE	24931	28P264-1
-3	017-0520-00				CONN,PLUG,ELEC:50 OHM COAX	80009	017-0520-00
-4	131-2766-01				CONNECTOR,PROBE:PACKAGE OF 100	80009	131-2766-01
-5	136-0352-02				SOCKET,PIN CONN:U/W 0.019 DIA PINES	80009	136-0352-02
	THE SUBMINIATURE-TO-MINIATURE PROBE TIP ADAPTER IS REQUIRED TO USE THESE ACCESSORIES.						
7-5-6	013-0202-00				ADAPTER,PROBE:MINI	80009	013-0202-00
-7	015-0325-00				ADAPTER,PROBE:PROBE TO CONNECTOR PINS	80009	015-0325-00
-8	206-0222-00				TIP,PROBE:MICROCIRCUIT TEST	80009	206-0222-00
-9	013-0084-01				ADAPTER,CONN:BNC TO PROBE	24931	28P156-1
-10	017-0088-00				CONN,PLUG,ELEC:50 OHM,GR TO 7A11 PROBE	80009	017-0088-00
-11	013-0085-00				TIP,PROBE:GROUNDING,P6038	80009	013-0085-00
-12	013-0191-00				TIP,PROBE:W/ACTUATOR		
-13	195-4104-00				LEAD,ELECTRICAL:23 AWG,6.3 L,O-N	80009	195-4104-00